FINAL

[redacted] Submittal
(Revised)

FAMILY HOUSING INSULATION ENERGY CONSERVATION OPPORTUNITY (ECO) STUDY

Ft. Belvoir, Virginia

Department of the Army
Baltimore District
U.S. Army Corps of Engineers

COE Project No. DACA 31-92-D-0061
Delivery Order NO. 0005

EYP Project No. 60592.00

[redacted]

Nov 1, 1995

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January 24, 1995

Mr. James Hawk
CENAB/AE Acquisition Branch
10 South Howard Street
Baltimore, MD 21201

Re: Pre Final Submission (Revised)
Family Housing Insulation (ECO) Study
COE Project No. DACA31-92-D-0061
Delivery No. 0005
EYP Project No. 60592.00

Dear Mr. Hawk:

EYP hereby submits the revised Pre Final Submittal of the referenced project as requested. This submittal incorporates all the corrections required by comments to date from your office and from Mr. Mike Stumbaugh of DPW/Ft. Belvoir, including revisions of both narratives and calculations.

Please feel free to call me at (202) 471-5183 if there is any question in regard to this submittal.

EINHORN YAFFEE PRESCOTT
ARCHITECTURE & ENGINEERING, PC

Julius Stone, P.E.
Project Manager

Enclosure (1copy of Pre Final Submittal - Revised)

cc: Mr. Mike Stumbaugh, DPW/Ft. Belvoir

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Pre-final Submittal
(Revised)

FAMILY HOUSING INSULATION ENERGY CONSERVATION OPPORTUNITY (ECO) STUDY

Ft. Belvoir, Virginia

Department of the Army
Baltimore District
U.S. Army Corps of Engineers

COE Project No. DACA 31-92-D-0061
Delivery Order NO. 0005

EYP Project No. 60592.00

January 18, 1995

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I. EXECUTIVE SUMMARY

A. INTRODUCTION

Six (6) family housing groups on the installation of Ft. Belvoir, including both detached and duplex type housing units, have been selected as 'prototypes' for this limited scope energy study. In general, these housing units are in good condition, but are not energy efficient by today's standard. In order to meet the requirements of Executive Order 12902 (March 8, 1994): Energy Efficiency and Water Conservation at Federal Facilities', various types of passive and active energy conservation measures were selected for detailed study to determine their viability based on life cycle cost analysis. 'Active' measures include those which require the installation of new or replacement electrical/mechanical equipment which would improve the energy performance of the operation of housing units as a whole, such as high efficiency lighting fixtures, programmable thermostats and whole house fans, etc. 'Passive' measures include those which improve the thermal characteristics of the structure, such as addition of insulation to exterior walls/attic/crawl space, addition of storm windows or replacement of single pane with double pane type, etc.

The intent of the study is to establish the current level of energy consumption for each of the prototype housing groups ('baselines'), and to recommend energy conserving options, known as 'Energy Conservation Opportunities' (ECOs), which demonstrate through heating and cooling load calculations and life cycle cost simulations to be economically viable. The ECOs which meet the criteria of Energy Conservation Investment Program (ECIP) are then packaged for funding requisition purposes, and recommendations for these prototypes may be applied to other housing groups on base with similar characteristics and projected performance.

ECIP analysis summaries for ECOs evaluated and recommended are included in this study and may be found in the Appendices.

B. PROJECT SUMMARY

Of a total of eleven(11) potential ECOs analyzed in this study, six(6) are being recommended for ECIP implementation for applicable housing groups:

- Insulation of exterior walls
- Insulation of floor over unheated crawl spaces
- Selective installation of high efficiency fluorescent light fixtures
- Reactivation of existing whole house fans or installation of new ones
- Installation of programmable thermostats
- Insulation of domestic water heaters in unheated crawl spaces

Each of the housing areas was analyzed using the 'Multiple ECO' simulation of the ASEAM routine. The resultant projection in energy savings therefore do reflect the synergistic effect of the implementation of multiple ECOs.

The recommended ECOs have been packaged into seven(7) ECIP projects (two projects for the 'RIVER VILLAGE 1600 AREA' group, one for each of the other groups). This packaging approach makes it possible to compute the 'Savings-to-Investment Ratio' (SIR) and the payback period, with appropriate consideration of the synergistic effect. With all recommended ECOs implemented, the projected savings in energy for these six housing groups would be **13,161 MBtu** per year, or **24.5%** of the existing level. The savings in energy costs would be **$ 171,686** per year, or **24.9%** of the existing level. The total cost of the seven ECIP packages, including SIOH and design fee, is **$ 827,784**, for an average simple payback of 5 years.

Itemized energy/energy cost savings, first costs and SIR/pay backs for each housing group are included in TABLE 1: 'LIST OF ECO'S RECOMMENDED FOR IMPLEMENTATION' of the Executive Summary.

C. ENERGY CONSERVATION ANALYSIS

1. ECOs Investigated

A number of energy conservation opportunities (ECOs) have been investigated to determine their potential for more detailed analysis as described in this study:

a. HVAC Equipment and Controls:

- Furnace/air-conditioning system
- Attic ventilation system
- Whole house ventilation system
- Domestic water heaters
- Programmable thermostats

b. Weatherization:

- Insulation of envelope (wall, roof/attic, floor over crawl space, etc.)
- Storm windows and storm doors
- Weatherstripping
- Shading

c. Lighting:

- New fixtures
- Re-lamping of existing fixtures

2. ECOs Rejected

The following is a listing of the ECOs rejected after investigation. Explanations of rejection are provided in section 'IV. BUILDING ANALYSIS'.

a. HVAC Equipment and Controls:

- Furnace/air-conditioning unit replacement
- New attic ventilation fans
- Domestic water heater replacement

b. Weatherization:

- Add storm windows and storm doors
- Add weatherstripping
- Add Shading
- Insulate basement Walls

c. Lighting:

- Re-lamping of existing fixtures

3. ECOs Recommended

Based on:

a. Initial cost of each Energy Conservation Opportunity (ECO) as determined through local market research;
b. Result of computer modeling of building air-conditioning and heating energy calculation program **ASEAM** and
c. Result of life cycle cost analysis program **BLCC**

The following ECOs are recommended for implementation through the Energy Conservation Investment Program (ECIP) projects. Each of these ECOs has a Savings-to-Investment Ratio (SIR) of 1.25 or higher, and therefore meets the ECIP requirement. Energy and energy cost savings shown are for each housing unit group.

TABLE 1: List of ECO's Recommended for ECIP Projects

ECO Description	1995 Cost (Including SIOH, Design ($)	1995 Energy Cost Savings ($)	1995 Energy Savings (MBTU/YR)			SIR	Simple Payback Period (Year)
			Elec	Gas	Total		
GERBER VILLAGE - 100 Area - No Basement (22 Units)							
1. Insulate Exterior Walls	95,524	11,264	433	600	1,033	N/A	N/A
2. Insulate over crawl space	17,380	4,642	156	311	467	N/A	N/A
3. Replace 3 Light Fixtures with Fluorescent type	7,766	81454	54	(-)22	32	N/A	N/A
4. Activate whole house fan and install programmable thermostats	14,542	11,462	560	264	824	N/A	N/A
ECIP Project No. 1: Multiple ECO's 1 to 4	**135,200**	**32,748**	**1,404**	**1,327**	**2,731**	**3.72**	**5**
GERBER VILLAGE - 100 Area - With Basement (36 Units)							
1. Insulate Exterior Walls	129,709	18,000	688	972	1,660	N/A	N/A
2. Insulate over crawl space	22,498	4,176	150	185	335	N/A	N/A
3. Replace 3 Light Fixtures with Fluorescent type	12,701	1,260	92	(-)35	57	N/A	N/A
4. Activate whole house fan and install programmable thermostats	23,789	18,828	857	623	1,480	N/A	N/A
ECIP Project No. 2: Multiple ECO's 1 to 4	**188,698**	**50,276**	**2,092**	**2,221**	**4,313**	**4.37**	**4**

ECO Description	1995 Cost (Including SIOH, Design ($)	1995 Energy Cost Savings ($)	1995 Energy Savings (MBTU/YR)			SIR	Simple Payback Period (Year)
			Elec	Gas	Total		
166-171 AREA - (12 Units)							
1. Insulate Exterior Walls	36,516	4,404	172	228	400	N/A	N/A
2. Insulate over crawl space	1,451	1,596	62	82	144	N/A	N/A
3. Replace 3 light fixtures with fluorescent type	4,234	420	27	(-)9	18	N/A	N/A
4. Activate whole house fans and install programmable thermostat	11.088	4,392	164	114	278	N/A	N/A
ECIP Project No. 3 Multiple ECO's: 1 to 4	**57,429**	**10,176**	**475**	**316**	**791**	**2.67**	**6**
T-400 AREA - T - SHAPE (20 Units)							
1 Replace 3 Light Fixtures with Fluorescent type	7,056	940	63	(-)27	36	N/A	N/A
2. Insulate water heaters	941	360	61	0	61	N/A	N/A
3. Install new whole house fans and programmable thermostat	25,379	7.240	364	137	501	N/A	N/A
ECIP Project No. 4: Multiple ECO's 1 to 4	**33,380**	**8,465**	**421**	**175**	**596**	**3.76**	**4**

ECO Description	1995 Cost (Including SIOH, Design ($)	1995 Energy Cost Savings ($)	1995 Energy Savings (MBTU/YR)			SIR	Simple Payback Period (Year)
			Elec	Gas	Total		
T-400 AREA 'L' SHAPE (14 Units)							
1. Insulate over crawl space	21.210	6,510	231	483	659	N/A	N/A
2 Insulate water heaters	659	154	43	0	43	N/A	N/A
3. Replace 3 light fixtures with Fluorescent type	4.939	630	44	(-)23	21	N/A	N/A
4. Install new whole house fans and programmable thermostat	17,248	4,102	139	272	411	N/A	N/A
ECIP Project No. 5 **Multiple ECO's : 1 to 4**	**47,118**	13,930	560	672	1,232	4.57	4
RIVER VILLAGE 1600 AREA (188 Units)							
ECIP Project No. 6: 1. Replace 3 light fixtures with Fluorescent type	66,326	11,280	661	(-)63	598	2.46	6
ECIP Project No. 7: 1. Activate whole house fans and install programmable thermostat	238,564	46,582	2,435	621	3,056	2.84	6
ECIP Projects Nos. 6 & 7 Combined Multiple ECO's	304,893(*)	56,024	3,023	475	3,498	N/A	N/A

(*) Cost of multiple ECO's exceeds $300,000, the two ECOs are therefore packaged separately, but the energy savings shown reflects the synergistic effect.

4. ECIP Projects Developed

Per the direction of the Installation, seven(7) ECO packages have been developed based on ECIP project guidelines, as follows. **ECIP Nos. 6** and **7**, both for **River** Village 1600 Area, if combined, would exceed $300,000 in cost. They are therefore packaged separately.

ECIP No. 1: Gerber Village 100 Areas with no basement (22 units)

- Insulate exterior walls
- Insulate over crawl space
- Replace 3 incandescent light fixtures with high efficiency fluorescent type
- Reactivate existing whole house fans
- Install programmable thermostats

ECIP No. 2: Gerber Village 100 Areas with basement (36 units)

- Insulate exterior walls
- Insulate over crawl space
- Replace 3 incandescent light fixtures with high efficiency fluorescent type
- Reactivate existing whole house fans
- Install programmable thermostats

ECIP No. 3: 166-171 Area (12 units)

- Insulate exterior walls
- Insulate over crawl space
- Replace 3 incandescent light fixtures with high efficiency fluorescent type
- Install new whole house fans
- Install programmable thermostats

ECIP No. 4: T-400 Area "T"-shape Houses (20 units)

- Replace 3 incandescent light fixtures with high efficiency fluorescent type
- Install new whole house fans
- Install programmable thermostats
- Insulate domestic water heaters

ECIP No. 5: T-400 Area "L"-shape Houses (14 units)

- Insulate over crawl space
- Replace 3 incandescent light fixtures with high efficiency fluorescent type
- Install new whole house fans
- Install programmable thermostats
- Insulate domestic water heaters

ECIP No. 6: River Village 1600 Area (188 units)

- Replace 3 incandescent light fixtures with high efficiency fluorescent type

ECIP No. 7: River Village 1600 Area (188 units)

- Install new whole house fans
- Install programmable thermostats

The 'Life Cycle Cost Analysis Summary - Energy Conservation Investment Program (ECIP)' for each ECIP is attached herein as well as in Appendix I.

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA REGION NO. 3 PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO) FISCAL YEAR 95
DISCRETE PORTION NAME: Gerber Village 100 Area - No Basement: Multiple ECO's ECIP No. 1
ANALYSIS DATE: Jan '95 ECONOMIC LIFE 20 PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 120,714		
B.	SIOH	$ 7,243		
C.	DESIGN COST	$ 7,243		
D.	TOTAL COST (1A+1B+1C)	$ 135,200		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 135,200

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994) DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	1,404	$ 24,682	15.61	$ 385,291
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	1,327	$ 8,066	20.96	$ 169,081
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		2,731	$ 32,748		$ 554,372

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4. FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE)): $ 32,748
5. SIMPLE PAYBACK (1G/4): 5 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C): $ 554,372
7. SAVINGS TO INVESTMENT RATIO (SIR) 6/1G: 3.72

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA REGION NO. 3 PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO) FISCAL YEAR 95
DISCRETE PORTION NAME: Gerber Village 10 0 Area - With Basement: Multiple ECO's ECIP No. 2
ANALYSIS DATE: Jan '95 ECONOMIC LIFE 20 PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 168,480		
B.	SIOH	$ 10,109		
C.	DESIGN COST	$ 10,109		
D.	TOTAL COST (1A+1B+1C)	$ 188,698		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 188,698

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994) DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	2,092	$ 36,775	15.61	$ 574,094
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	2,221	$ 13,501	20.96	$ 282,990
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		4,313	$ 50,276		$ 857,084

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4. FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE)): $ 50,276
5. SIMPLE PAYBACK (1G/4): 4 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C): $ 857,084
7. SAVINGS TO INVESTMENT RATIO (SIR) 6/1G: 4.37

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA REGION NO. 3 PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO) FISCAL YEAR 95
DISCRETE PORTION NAME: 166-171 Area: Multiple ECO's ECIP No. 3
ANALYSIS DATE: Jan '95 ECONOMIC LIFE 20 PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 51,276		
B.	SIOH	$ 3,076		
C.	DESIGN COST	$ 3,076		
D.	TOTAL COST (1A+1B+1C)	$ 57,429		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 57,429

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994) DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	475	$ 8,354	15.61	$ 130,351
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	316	$ 1,922	20.96	$ 40,263
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		791	$ 10,176		$ 170,624

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4. FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE)): $ 10,176
5. SIMPLE PAYBACK (1G/4): 6 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C): $ 170,624
7. SAVINGS TO INVESTMENT RATIO (SIR) 6/1G: 2.67

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA REGION NO. 3 PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO) FISCAL YEAR 95
DISCRETE PORTION NAME: T-400 Area 'T'-shape units: Multiple ECO's ECIP No. 4
ANALYSIS DATE: Jan '95 ECONOMIC LIFE 20 PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 29,804		
B.	SIOH	$ 1,788		
C.	DESIGN COST	$ 1,788		
D.	TOTAL COST (1A+1B+1C)	$ 33,380		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 33,380

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994) DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	421	$ 7,401	15.61	$ 115,532
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	175	$ 1,064	20.96	$ 22,298
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		596	$ 8,465		$ 137,830

3. NON-ENERGY SAVINGS (+) OR COST (-):

A. ANNUAL RECURRING (+/-) $
(1) DISCOUNT FACTOR (TABLE A)
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) $ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4. FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE): $ 8,465
5. SIMPLE PAYBACK (1G/4): 4 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C): $ 137,830
7. SAVINGS TO INVESTMENT RATIO (SIR) 6/1G: 3.76

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA REGION NO. 3 PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO) FISCAL YEAR 95
DISCRETE PORTION NAME: T-400 Area "L"-shape units: Multiple ECO's ECIP No. 5
ANALYSIS DATE: Jan '95 ECONOMIC LIFE 20 PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 42,069		
B.	SIOH	$ 2,524		
C.	DESIGN COST	$ 2,524		
D.	TOTAL COST (1A+1B+1C)	$ 47,118		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 47,118

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994) DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	560	$ 9,845	15.61	$ 153,677
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	672	$ 4,085	20.96	$ 85,623
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		1,232	$ 13,930		$ 239,300

3. NON-ENERGY SAVINGS (+) OR COST (-):

A. ANNUAL RECURRING (+/-) $
(1) DISCOUNT FACTOR (TABLE A)
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) $ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4. FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE): $ 13,930
5. SIMPLE PAYBACK (1G/4): 4 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C): $ 239,300
7. SAVINGS TO INVESTMENT RATIO (SIR) 6/1G: 4.57

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA REGION NO. 3 PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO) FISCAL YEAR 95
DISCRETE PORTION NAME: River Village 1600 Area: Replace 3 Light Fixtures with Fluorescent type ECIP No. 6
ANALYSIS DATE: Jan '95 ECONOMIC LIFE 20 PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 59,220		
B.	SIOH	$ 3,553		
C.	DESIGN COST	$ 3,553		
D.	TOTAL COST (1A+1B+1C)	$ 66,326		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 66,326

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994) DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	661	$ 11,620	15.61	$ 181,394
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	(-) 63	$ (-) 383	20.96	$ (-) 8,027
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		598	$ 11,280		$ 173,367

3. NON-ENERGY SAVINGS (+) OR COST (-):

A. ANNUAL RECURRING (+/-) $
(1) DISCOUNT FACTOR (TABLE A)
(2) DISCOUNTED SAVINGS/COST (3A X 3A1) $ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4. FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE): $ 598
5. SIMPLE PAYBACK (1G/4): 6 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C): $ 173,367
7. SAVINGS TO INVESTMENT RATIO (SIR) 6/1G: 2.46

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA REGION NO. 3 PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO) FISCAL YEAR 95
DISCRETE PORTION NAME: River Village 1600 Area: Install Whole House Fans & Prog. Thermostats ECIP No. 7
ANALYSIS DATE: Jan '95 ECONOMIC LIFE 20 PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 213,003		
B.	SIOH	$ 12,780		
C.	DESIGN COST	$ 12,780		
D.	TOTAL COST (1A+1B+1C)	$ 238,564		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 238,564

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994) DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	2,435	$ 42,807	15.61	$ 668,222
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	621	$ 3,775	20.96	$ 79,125
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		3,056	$ 46,582		$ 747,347

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4.	FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE):	$ 46,582
5.	SIMPLE PAYBACK (1G/4):	6 YEARS
6.	TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C):	$ 747,347
7.	SAVINGS TO INVESTMENT RATIO (SIR) 6/1G:	2.84

5. Operational or Policy Change Recommendations

No operational or policy change is recommended for the housing units studied. Existing policy of the Housing Office has served the Installation well, and there is no compelling reason to change it.

D. ENERGY AND COST SAVINGS

See TABLE 2 for the following:

1. Projected energy and energy cost savings and
2. Projected percentage of energy saved.

TABLE 2: ENERGY AND ENERGY COST SAVINGS SUMMARY
(Total of all six housing groups)

Category	Existing Energy Consumption/Cost	Projected Energy Consumption/ Cost	Savings in Energy/Cost: Quantity	Savings in Energy/Cost: %
Energy/Year:				
Electricity (MBtu)	30,014	22,039	7,975	26.6
Gas (MBtu)	23,789	18,603	5,186	21.8
Total (MBtu)	**53,803**	**40642**	**13,161**	**24.5** (average)
Energy Cost/Yr.: Dollars ($)	**689,452**	**517,766**	**171,686**	**24.9**

NOTES: 1. Utility costs based on $ 17.575/MBtu ($ 0.06/kWh) for electricity, — demand charge?
$ 6.082/MBtu ($ 0.68/therm) for natural gas.
2. Projected savings based on implementation of all seven(7) ECIP projects.

II. PURPOSE AND SCOPE

A. PURPOSE

This study is intended to establish the current state of energy consumption in six neighborhoods on the Installation, and recommend economically viable options to improve energy efficiency of the buildings as evaluated against Energy Conservation Investment Program (ECIP) criteria. Potential energy conservation opportunities (ECOs) would be analyzed through computer modeling, the results of which would form the basis of the recommendations of this study.

B. SCOPE OF WORK

1. Buildings to Be Evaluated

The study population consists of six different family housing models as follows:

a. Gerber Village, 100 Area: 2 story, 4 bedroom houses without basement. 22 units.
b. Gerber Village, 100 Area: 2 story, 4 bedroom houses with basement. 36 units.
c. 166-171 Area: 3 story, 3 bedroom duplex houses. 12 units (6 buildings).
d. T-400 Area "T" shape: 1 story, 3 bedroom houses. 20 units.
e. T-400 Area "L" shape: 1 story, 3 bedroom houses. 14 units.
f. River Village, 1600 Area: 2 story, 3 bedroom duplex houses. 188 units (94 buildings).

2. Requirement of Building Audits

The condition and the thermal characteristics of the housing units shall be assessed through selective building audits. A minimum of five (5) percent of each housing model shall be surveyed, and all relevant field data gathered shall be recorded on standard survey forms and submitted as part of the study. See 'III. BUILDING AUDITS' for detailed description of work requirements.

3. Energy Conservation Opportunities (ECOs)

ECOs to be analyzed for feasibility under this study include:

a. Weatherstripping/caulking for doors and windows - including storm doors/windows;
b. Insulation of building envelope - installation of new insulation or enhancement of existing insulation for walls, attic, basement walls and crawl space;
c. Storm doors - installation of new storm doors or replacement of existing ones, including replacement of frames;
d. Storm windows - installation of new storm windows or replacement of existing ones, including replacement of frames;
e. Attic mechanical ventilation system - installation of new whole house fans or reactivation of existing ones; installation of gable-mounted attic fans;
f. Replacement of existing incandescent light fixtures with fluorescent types; and
g. Insulation of domestic water heater and distribution piping.

4. ECO Analysis

The ECOs listed above will be analyzed against the existing conditions established for each model type and projected out over the model population. Each ECO will be analyzed individually for energy and cost savings using ECIP criteria. The total project will be extrapolated into a complete ECIP document suitable for submission into the program for funding.

5. Market Analysis

A market analysis will be conducted to determine efficient and reliable products to successfully realize the potential of each ECO. At least one product will be recommended

for each ECO evaluated (e.g. insulation, fan, lighting fixture). Price information and specifications will be provided. See 'IV. BUILDING ANALYSIS, E. Market Analysis'.

III. BUILDING AUDITS

A. SURVEY METHODOLOGY

1. Approach

Five percent (5%) of the housing units from each neighborhood (also referred to as "Areas") were sampled for audit, and it is assumed that these sample units are representative of the entire respective study area. Where variances in construction were found in sample units of any neighborhood, they were noted accordingly for analysis of impact.

2. Recording of Data

A Field Survey Form was completed for the first unit audited in each neighborhood. This form was then used as a basis for comparison for the other units in the area being audited. (Copies of all completed survey forms may be found in Appendix A). Variances from the first unit that were found in the remaining units were noted on page 4 of the Survey Form. Interviews with residents were completed for at least two units of every group. This was to determine conditions not present at the time of the survey. For instance, a resident could report whether walls were cold during the winter. This fact could not necessarily be observed during a survey on a warm day in mid-November.

3. Wall Construction

Three methods were used to determine wall construction: visual observation of open walls, previous experience with similar residential structures and interviews with residents and maintenance personnel.

B. DESCRIPTION OF EXISTING CONDITIONS

1. General

All of the housing units audited appear to be in either good or very good overall condition. This is attributable to a sound maintenance/improvement program in place over the years. It is evident that there has been an on going energy conservation program.

Measures taken to improve building envelope performance included improving insulations and installing storm doors and windows.. With the exception of Gerber Village, 166-171 Area Sun rooms and T-400"L" units, crawl spaces have been insulated with batt insulation. Efforts to insulate walls after construction have been limited to the T-400 units, as previously mentioned and are one of the primary ECOs considered in this study. Attic insulation is also very consistent. All audited units appear to have the same depth of blown-in material.

Weatherizing of openings also appears relatively consistent. With the exception of the-400 Area, all units have been retro-fitted with storm doors and windows. There was particular attention to details in areas such as covering sash pockets in Gerber Village. T-400 units

have been recently retro-fitted with conventional vinyl clad wood windows with double pane glazing. T-400 units do have storm doors in place. Overall condition of the weatherstripping is fair.

Ventilation of attics and crawl spaces varied with each area.

All water heaters and HVAC equipment observed are about the same age and model regardless of the units studied. Furnaces are high efficiency, gas-fired, pulse combustion type, with humidifiers retro-fitted. Residents reported the humidifiers were unreliable. Gas water heaters and furnaces appear less than 10 years old. One of the units surveyed had mechanically assisted attic fans. While Gerber is the only neighborhood with whole house fans, they have been disconnected.

2. Variances

Two potentially significant variances were observed during the surveys. River Village has three types of facades. The differences lie in the ratio of siding to brick on the front facade and the nature of the shading devices employed. U values of 4" face brick and wood lap siding are virtually identical, allowing this variance to be ignored. The role of the shading devices employed was also small enough to be ignored. The second major variance is the presence of bedroom additions on the T-400"L" units.

3. Description by Model

a. 100 Area - Gerber Village:
2 Story, 4 Bedroom house without Basement - 22 units (Code: GV1A)
2 Story, 4 Bedroom house with Basement - 36 units (Code: GV1B)

(1) General

Gerber Village was developed as, and remains a single family housing area. The design and construction is consistent with construction practices of the 40's and 50's: solid masonry construction with wood frame floors and roofs. Elements currently considered energy conservation features were typically treated as items of comfort, e.g. insulation in the attic. Thus thermal considerations throughout the envelope were minimal. Recent efforts to optimize thermal performance are consistent with other efforts throughout the sample population.

(2) Building Envelope

The presence of 6th course headers in the common bond brick and no weep holes strongly suggest exterior walls are double width masonry walls without an airspace. The interior finish is probably gypsum board on furring. Currently there is no insulation.

In units with basement, the basement walls are of concrete. Access to the crawl spaces in these units is through a small door in the basement. These plywood doors are typically ill fitting and residents complain of drafts.

Wood framed floors are finished in hardwood. It could not be determined if the crawl space in units without basements have insulation. The crawl space in units with basements have not been insulated. Crawl spaces have ventilation as described under the "ventilation" paragraph.

Each Gerber building has three roofs: a flat roof over the dining room, and pitched roofs over the main house, kitchen and rear entry. The main roof attic has approximately 16 inches of blown-in insulation over the original batts. Insulations in the other two (smaller) roofs could not be confirmed. It has been assumed they have none.

(3) Openings

Windows are the original wood-frame, double-hung type with single pane glazing and sash weights. Openings have been retro-fitted with aluminum storm windows which cover the sash pockets. Infiltration potential appears low as confirmed by interviews with residents.

Exterior doors are insulated metal type with 2 small glazing panes. Storm doors are aluminum and glass. Weatherstripping is missing at front doors and needs maintenance at the side doors.

(4) Ventilation

Natural ventilation is provided for crawl spaces and attics. Crawl spaces are vented via nominal 3" x 8" brick vents, 2 per wall. Passive ventilation in the main roof is accomplished with an oversized gable vent. No eave vents were observed. The smaller pitched roof is also ventilated via a gable vent. Connection between these two roofs was not verified.

There is a mechanical ventilation system in the building.

(5) Mechanical Equipment and Lighting

Water heaters are in the unheated mechanical room in units without basements. In the units with basements the hot water heaters are located in the basement. Water heaters in both types of units are not insulated. Ceiling light fixtures are standard incandescent type.

b. **166-171 Area:**

3 Story, 3 Bedroom Duplexes - 12 units (Code: 166)

(1) General

These duplex units are similar to those built on Army bases throughout the Mid-Atlantic during the 20's and 30's. Solid masonry construction with wood frame floors and roofs. These units have a basement and a sun room created from built in porches. Thermal considerations during design and construction, throughout the envelope were minimal. Recent efforts to

optimize thermal performance are consistent with other efforts throughout the sample population.

(2) Building Envelope

As with Gerber Village, 6th course headers and no weeps strongly suggest exterior walls are double width masonry walls without an airspace. The interior finish is gypsum board on furring. Currently there is no insulation. Basement walls are of concrete. Access to the crawl space is provided via a plywood access door.

Wood framed floors are finished in hardwood. Sun room floors, which are over crawl spaces, do not have insulation. Crawl spaces are ventilated as described under 'Ventilation' paragraph.

Steeply pitched wood frame attics have approximately 10 inches of blown-in insulation over the original 4-inch batts.

(3) Openings

Windows are the original wood-frame, double-hung type with single pane glazing and sash weights. Openings have been retro-fitted with aluminum storm windows which cover the sash pockets. Infiltration potential appears low as confirmed by interviews with residents.

Exterior doors are insulated metal type with 2 small glazing panes. A small vestibule exists at the front entry, which acts as an air lock when properly used. Storm doors are aluminum and glass. Weatherstripping is in fair shape throughout.

(4) Ventilation

Natural ventilation is provided for crawl spaces and attics. Sun room crawl spaces are vented via nominal 3" x 8" brick vents, 1 each on the short walls. Passive ventilation in the main roof is accomplished with two rectangular vents. No eave vents were observed.

There is no mechanical ventilation system in the buildings.

(5) Mechanical Equipment and Lighting

Water heaters are located in the basements and are not insulated. Ceiling light fixtures are standard incandescent type.

c. **T-400 Areas:**

1 Story, 3 Bedroom House, 'T' Shape - 20 units (Code: 400T)
1 Story, 4 Bedroom House, 'L' Shape - 14 units (Code: 400L)

(1) General

These wood frame units were originally constructed during the 40's as temporary housing (hence the 'T' designation). However, due to the upkeep and original quality of construction they have maintained well over the years. The floor, wall and attic design has readily lent itself to thermal improvements. For the most part such measures have already been undertaken.

(2) Building Envelope

Exterior wall cavities were not insulated. However the original wood siding has since been replaced with insulated vinyl siding. This was originally observed by residents present during the replacement and has been confirmed by Fort Belvoir DEH. Crawl space walls are cast in place concrete.

Hardwood flooring covers the wood frame floor. 4-inches of batt insulation have been installed in all of the T shaped units while L shaped units have no insulation in the crawl spaces.

All attics observed have blown-in insulation ranging in depth from 5" to 10"; with the majority at least 9". This is in addition to the original 4" batt insulation.

(3) Openings

During the installation of new siding, vinyl clad wood, double hung windows with double pane glazing were installed. Residents report these windows are tight when properly locked. Windows have screens but no storm windows.

Exterior doors are insulated metal. The top portion of the doors have 9 glazing lights. "L" shaped buildings have a pair of french doors leading to the porches. Storm doors are present at all exterior doors and are aluminum and glass. Infiltration potential is low and residents report drafting is at a minimum. However, the weatherstripping does require maintenance.

(4) Ventilation

Both eave and gable vents are present for the attics. Notable exceptions are units T-441 and T-442 ("T" shaped units) which have windows to the attic in lieu of gable vents. From outside observation these attics do not appear to be occupied.

Openings for the crawl space brick vents are present in all "T" shaped units. One opening is consistently blocked while the other has a conventional

screen. "L" shaped units have perforated siding panels over the foundation walls, however, the foundation walls appear to have no openings to work with these perforations. Both of these conditions violate most codes which require cross ventilation in crawl spaces.

There is no mechanical ventilation system in the building.

(5) Mechanical Equipment and Lighting

In the "T" shaped buildings, the furnace and water heater are located in an excavated crawl space, and therefore exposed to the ambient temperature. "L" shaped buildings have the mechanical equipment and water heater in an unheated closet at the end of the building. Water heaters are undersized and residents often have difficulty maintaining enough hot water during showers. Further, water heaters in "L" shaped units are remote to bathrooms, requiring excessive water consumption to bring heated water to fixtures. "L" shaped buildings observed have ceiling fans in key locations throughout the house. Ceiling light fixtures are incandescent type except in kitchen and laundry room, where the fixtures are of the fluorescent type.

(6) Miscellaneous

All T-400 units have operable fireplaces. The fireplace flue damper of unit 480 was noted to be broken, creating a drafty condition.

Most of the T-400s are built in old forests. The advanced development of the forest canopies offers passive temperature modulation, though winter solar gain is dampened.

d. **1600 Area - River Village:**

2 Story, 3 Bedroom Duplexes - 188 units (Code: RV16)

(1) General

These units were developed in the late 50's and early 60's. Construction design at this time design called out for wood frame construction to include insulation in wood frame wall cavities. Renovations of units in George Washington Village were underway during this survey. This made it possible to physically observe the elements of construction. It has been confirmed by base personnel these units were constructed at the same time and with the same technology as those in River Village.

(2) Building Envelope

Exterior walls are wood frame with a mixture of brick veneer and wood lap siding. As mentioned, cavities in the wood frame wall contain 3-1/2" batt insulation.

Visual observation through foundation vents revealed wood framed floors over crawl spaces are insulated with 4" batts.

The wood framed attic floor has 4" of batt insulation under an additional 6" of blow-in insulation.

(3) Openings

While design had evolved to improve wall performance, windows remained a single pane design. These double hung windows have single pane glazing and their working condition is fair. Without the aluminum frame storm windows, with glass and screen panels, the windows would have higher infiltration rates.

Front doors are flush wood solid core without glazing. Side doors are wood with 3 rows of 3 glazing panes each. The french door at the rear, includes astragals and have plastic weatherstripping versus the metal spring type ~~found on~~ the other doors. All doors have aluminum/glass storm doors in need of weatherstripping.

(4) Ventilation

The crawl space is ventilated via brick vents, one per building side. The attic space is ventilated via eave and gable vents.

Though there is no mechanical ventilation system in the buildings, it would appear that these units were design to receive whole house fans. Openings framed into the attic floor appear to be large enough to accommodate such devices.

(5) Mechanical Equipment and Lighting

Domestic water heaters are located in the center core of the first floor. Neither they nor the hot water piping are insulated. Ceiling light fixtures are standard incandescent type.

IV. BUILDING ANALYSIS

A. INTRODUCTION

1. Two computer programs are used to perform the required calculations for this study:

a. "A Simplified Energy Analysis Method, Version 3.0" (ASEAM 3.0) is a modified bin method program developed by the Department of Energy for calculating the energy consumption of residential and simple commercial buildings. This public domain program offers a number of advantages for projects such as this one, including:

(1) Use of standard algorithms from sources such as the DOE-2 program, the National Institute of Standards and Technology (NIST), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Illuminating Engineering Society (IES), etc.
(2) Selection of weather data in both DOD and ASHRAE formats.
(3) Calculates both peak and zone loads in thermal load analysis.

(4) Projects monthly and annual energy consumptions, and the respective energy costs, by fuel type.
(5) Energy Conservation Opportunities (ECOs) are studied by comparing baseline energy consumption and cost with alternative (ECO) energy consumption and cost. ECOs may be studied individually or in combinations with other ECOs.

Due to its relatively simple input format, which is by design, ASEAM has its limitations, too:

(1) It does not take the thermal load of ventilation air (i.e., outside air) into consideration in the peak load calculations.
(2) It does not generate sufficiently detailed equipment sizing information normally required for construction documents.

b. Building Life Cycle Cost, Version 4.0" (BLCC) is an life cycle cost analysis program developed by the National Institute of Standards and Technology (NIST) which supports the ASEAM program. BLCC provides economic analysis of proposed capital investments that are expected to reduce long-term operating costs of buildings or building systems/components. It is especially useful for evaluating the costs and benefits of energy conservation projects in buildings.

The BLCC program, which is also a public domain program, offers a number of features, including:

(1) Two or more alternatives can be evaluated to determine which has the lowest life cycle cost.
(2) Economic measures calculated include Net Savings; Savings-to-Investment Ratio (SIR); Adjusted Internal Rate of Return (AIRR) and Years to Payback.
(3) It can be used for evaluating federal (including DOD), state, and local government projects as well as private sector projects.
(4) It complies with ASTM standards related to building economics as well as FEMP and OMB Circular A-94 guidelines for economic analysis for federal building projects.
(5) It allows the user to create project specific rate schedules for utility costs when standard schedules do not meet the need.

B. METHODOLOGY

1. Establishment of Baseline Model

Data collected through building audits are screened and incorporated into the ASEAM input files to generate baseline information regarding existing conditions. Thus **'baseline'** represents the "as is" condition of each type of housing units, including the thermal characteristics of building envelope (walls, windows and roofs), number of occupants, lighting load, miscellaneous equipment load (such as washer, dryer and cooking equipment) and the assumed average diversity of each of these loads on a daily and monthly basis.

Assumptions were also made on the average operating efficiency of the heating and air-conditioning system of the housing units.

2. Selection of Energy Conservation Opportunities (ECOs)

ECOs specified in the Scope of Work are analyzed individually via computer analysis, following these procedures:

a. For each ECO to be analyzed, a **single ECO** input file would be generated in the ASEAM program to determine its projected savings in energy when compared with the **baseline** input (refer to paragraph 'C. Characteristics of ECOs' for explanation of how each ECO input file differs from the **baseline** file).
b. Economic data for each ECO would then be used to calculate the savings-to-investment ratio (SIR) through the BLCC program.
c. Those ECOs with individual SIR exceeding 1.25 would then be grouped together by housing group (i.e., neighborhood), and a **multiple ECO** file would be generated for each group to calculate the total energy savings with synergistic effect taken into consideration. These ECOs would be packaged and recommended per Energy Conservation Investment Program (ECIP) project guidelines for funding consideration.
d. Output from each **multiple ECO** analysis would then be used to perform the final life cycle cost analysis for each ECIP project through the BLCC program, yielding the SIRs and simple pay backs.

3. Listing of ECOs Selected for Analysis

a. ECOs chosen for computer analysis (ASEAM/BLCC):

- Insulation of exterior walls (except basement)
- Insulation of underside of floors over crawl space
- Installation/reactivation of whole house fans and installation of programmable thermostats
- Light fixture replacement with fluorescent type(s)

b. ECOs chosen for manual analysis

- Insulation of domestic water heater (in crawl space)
- Installation of gable-mounted attic fans

c. Description of work

Insulation of exterior walls Blown-in insulation for first and second floor walls: Two holes would be drilled in each furring cavity of the exterior walls: one near the ceiling and one near the mid-point, for cellulose insulation to be blown in and fill the cavity. Holes will be patched by the insulation contractor, and refinished by the drywall contractor. The depth of cavities vary from 1 inch (Gerber Village 100 Areas and 166-171 Area) to 3 inches (400 Areas), therefore affecting the final R-value of the insulated walls.

Insulation for basement walls: 1.5" Rigid insulation between 2 channels from basement ceiling to 2 feet below grade (total weight approximately 4"), with ½" gypsum wall board taped and spackled. Existing interior side of walls should be tested for existence of lead-based paints before this work starts. Costs of abatement for lead-based paint are not included in the ECO analyses of this report.

Insulation of underside of floors over crawl space Fiberglass insulation batts of R-11 insulating value (minimum) and with kraft paper backing would be installed between floor joists at crawl space. Insulation would be held in place with spring type wire fasteners.

Installation/reactivation of whole house fans In housing units of Gerber Village 100 Areas, existing whole house fans would be reactivated by reconnecting fans to new power wiring and having new controls (both thermostatic controls and fan speed controls) installed. In River Village 1600 Area units, new whole house fans and associated controls would be installed in existing framed openings in second floor ceiling, currently covered with plywood panels. Work in 400 and 166-171 Area units would be same as for River Village except that new openings would have to be provided.

Light fixture replacement (with fluorescent type) An average of three (3) existing incandescent light fixtures in each housing unit, which are used the most during occupied hours, would be replaced ceiling-mounted fluorescent light fixtures (with one 32-watt T-8 lamp). Existing wiring would be reused.

Insulation of domestic water heaters in crawl space Domestic water heaters in 400 Area housing units would be insulated with a jacket of foil-backed fiberglass batts, which would have a minimum insulating value of R-5.

Installation of gable-mounted attic fans New attic fans would be mounted behind existing gable vent at one end of the attic, with thermostatic controls. Makeup air would be drawn in through gable vent at opposite end of attic.

4. Listing of ECOs Rejected (with explanation)

a. HVAC/Plumbing Equipment and Controls

(1) Furnace/air-conditioning system: Existing units are high efficiency type equipment, in good condition.
(2) Attic ventilation system: With existing high R-value attic insulation, the installation of attic fans would only yield very marginal savings in energy. Life cycle cost analysis confirmed that there is no reasonable payback.
(3) Domestic water heater replacement: Existing heaters are in good condition. Replacing them with slightly higher efficiency units would not be cost effective.

b. Weatherization

(1) Storm windows and storm doors: All housing units have storm windows and door in place, except 400 Area units, which do not have storm windows but have windows with double-pane glazing.
(2) Weatherstripping: Most of the weatherstripping on doors and windows are in good condition. The small percentage of exceptions could easily be serviced by the maintenance personnel.
(3) Shading: Permanent external shading devices are not practical for housing units, and are not compatible with the historic characteristics, either.

(4) Insulation of basement walls: negligible savings in energy, as basements are not air-conditioned, and are only nominally heated. SIR is below 1.25.

new fixtures?

c. Lighting

(1) Re-lamping of existing fixtures: Although re-lamping with compact lamps with twin- or quad-tubes would save energy, the configuration of existing 2- or 3-bulb incandescent fixtures makes it impossible to do so, due to the excessive length of such lamps. While most existing fixtures in basements would accept compact lamps, their infrequent usage does not justify the initial costs.

C. CHARACTERISTICS OF ECO'S

1. Comparison of ASEAM inputs for baseline and ECOs

The following baseline and ECO inputs are typical for all housing unit groups, and are used for the simulation of improved performance expected with the implementation of each ECO:

ITEM	BASELINE INPUT	ECO INPUT
• Wall Insulation	U = 0.33	U = 0.11
• Crawl Space Insulation	U = 0.40	U = 0.07
• Whole House Fan	Thermostat at 75°F summer	Thermostat at 80°F summer
• Programmable thermostats	Thermostat at 68°F winter-unoccupied	Thermostat at 55°F winter - unoccupied

2. For non-computer-based analyses and assumptions, see Appendix G.

D. COMPUTER MODELING

For this study, the ASEAM and the BLCC programs are employed to perform the following calculations for each housing unit group ("type"):

3. Annual building energy consumption and cost based on existing condition (**baseline**);
4. Annual building energy consumptions and cost based on implementation of individual ECOs;
5. Projected savings in energy and operating cost of ECOs vs. Baseline;
6. Life cycle cost comparison of Baseline and individual ECOs.

Since the housing units are not individually metered, costs of energy used in this study, including natural gas (for space and domestic water heating) and electricity (for lighting, air-conditioning and miscellaneous appliances), are based on history of utility costs as furnished by the post.

E. MARKET ANALYSIS

For each of the ECOs evaluated and recommended and which involves a specific product, at least one selection has been made. Selection information includes price(s) of the product(s), sources of pricing, cut sheets (where applicable), and a brief description of each product.

Building Insulation	Sources of Data
a. Wall Insulation (cellular dry, loose fill type for blown-in application, unless indicated otherwise)	1. Arlington Insulation (703-560-1050, Ms. Lea Zazquez): \$1.60/sf 2. Southland Insulators (703-631-6330, Mr. Jerry Palmer): \$1.65-1.75/sf (cellulose for 3" cavity); \$1.25/sf (cellulose for 1" air space) 3. Davenport Insulation (703-631-7744, Mr. Tony Coder): \$1.00/sf (cellulose for 3" cavity); \$0.65/sf (R-11 fiberglass batts, with gypsum walls removed)
b. Crawl Space Insulation (fiberglass batts, with foil vapor barrier)	1. Arlington Insulation (703-560-1050, Ms. Lea Zazquez): \$0.54/sf for R-19 2. Southland Insulators (703-631-6330, Mr. Jerry Palmer): \$0.55/sf for R-19; \$0.40/sf for R-11 3. Davenport Insulation (703-631-7744, Mr. Tony Coder): \$0.60/sf for R-19

Equipment Insulation	Sources of Data
a. Domestic Water Heater Insulation (R-11 fiberglass batt, with vapor barrier)	1. (EYP estimate) $5.00 for material, $35.00 for labor

Fluorescent Lighting Fixtures/Lamps	Sources of Data
a. Surface-Mounted Fluorescent Fixtures (48", 1-lamp or 24", 2 lamp)	1. 'Means Cost Data': $ 55 each 2. 'Lithonia' Catalog: Model GA140, Model 10621: $ 60 each
b. 48" fluorescent lamps	1. GE Lighting Division: (215-992-6606, Ms. Li Huang) a. Standard "Cool-White" 40-watt lamps (T-12): $ 1.80 each. b. Energy saving 32-watt lamps (T-8): $ 3.00 each.

Ventilation Fans	Sources of Data
a. Whole House Fans (New)	1. Benfield Electric Co. of Va.,Inc. (703-550-7081, Mr. J. Tharp): $656, fan(*), shutter and controls installed (*'Fasco Model 3038) 2. 'W.W. Grainger, Inc.' catalog: Emerson Model WH30FM: $340 (EYP est.)Controller: $60; Labor and materials to install: $165

Controls	Sources of Data
a. Programmable Wall Thermostats	1. B & B A/C and Heating (Alexandria/Springfield office, Mr. Sok Mun): Honeywell programmable t'stat: $280 installed (including $60 for labor) 2. 'W.W. Grainger, Inc.' catalog: Honeywell Model T8602C1046 and guard: $140.00
b. Whole House Fans Reactivated: New Controller	1. 'W.W. Grainger, Inc.'- Honeywell controller: $60 2. (EYP Estimate) Labor (2 man-hours): $80 3. (EYP Estimate) Replacing wiring: $25

III. ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

A. ECIP CRITERIA

1. General

The selection of ECIP projects for inclusion in this study has been done in compliance with the latest ECIP Guidance issued for circulation by Department of the Army (DAIM-FDF-U), dated 10 January 1994. All analyses are performed using the following economic parameters:

Current Year Discount Factor:	3.1%
Economic Analysis Life:	20 years (for 'Weatherization' and 'Electrical Energy Systems')
Minimum SIR (to qualify for ECIP recommendations):	1.25

2. Input Data

a. Energy Analysis

Energy savings data used in ECIP analysis are as calculated via computer program (see Appendix D: ASEAM Output).

b. Construction Costs

Initial cost and recurring/non-recurring costs associated with each ECIP project are as obtained through market analysis (see Appendix H: Cost Data).

B. RECOMMENDATION OF ECIP PROJECTS

The following are the recommended ECIP projects jointly developed with the Installation (Ft. Belvoir), based on the criteria described in paragraph 'A':

ECIP No. 1 Multiple ECO's for Gerber Village 100 Area (no basement)

A. Description of Work

1. Blown-in insulation for first and second floor walls: Two holes would be drilled in each furring cavity of the exterior walls: one near the ceiling and one near the mid-point, for cellulose insulation to be blown in and fill the cavity. Holes will be patched by the insulation contractor, and refinished by the drywall contractor. The depth of cavities is approximately 2 inches.
2. Fiberglass insulation batts of R-19 insulating value (minimum) and with kraft paper backing would be installed between floor joists at crawl space. Insulation would be held in place with spring type wire fasteners. Average headroom in crawl space is 24 inches.
3. An average of three (3) existing incandescent light fixtures in each housing unit, which are used the most during occupied hours, would be replaced ceiling-mounted fluorescent light fixtures (with one 32-watt T-8 lamp). Existing switches and electrical wiring would be reused.

4. Existing whole house fans would be reactivated by reconnecting fans to new power wiring and having new controls (both thermostatic controls and fan speed controls) installed. Existing motors shall be inspected and replaced as required.
5. Replace existing thermostats with electronic programmable type heating/cooling thermostats, so that space temperature during unoccupied winter hours may be reset for maximum energy savings. Provide new wiring and accessories as required.

B. Scope of Work

Gerber Village 100 Area single family houses (without basement), total of 22 units.

C. Quantities (per house)

1. 2,009 square feet of exterior wall.
2. 940 square feet of crawl space.
3. 3 fluorescent light fixtures.
4. One whole house fan.
5. One programmable thermostat.

D. Costs(*)

1. $6,145.44 per house.
2. $135,200 for the entire group.

*Costs shown include 6% for SIOH and 6% for Design Cost.

ECIP No. 2 Multiple ECO's for Gerber Village 100 Area (with basement)

A. Description of Work

1. Blown-in insulation for first and second floor walls: Two holes would be drilled in each furring cavity of the exterior walls: one near the ceiling and one near the mid-point, for cellulose insulation to be blown in and fill the cavity. Holes will be patched by the insulation contractor, and refinished by the drywall contractor. The depth of cavities is approximately 2 inches.
2. Fiberglass insulation batts of R-19 insulating value (minimum) and with kraft paper backing would be installed between floor joists at crawl space. Insulation would be held in place with spring type wire fasteners. Average headroom in crawl space is 24 inches.
3. An average of three (3) existing incandescent light fixtures in each housing unit, which are used the most during occupied hours, would be replaced ceiling-mounted fluorescent light fixtures (with one 32-watt T-8 lamp). Existing switches and electrical wiring would be reused.
4. Existing whole house fans would be reactivated by reconnecting fans to new power wiring and having new controls (both thermostatic controls and fan speed controls) installed. Existing motors shall be inspected and replaced as required.
5. Replace existing thermostats with electronic programmable type heating/cooling thermostats, so that space temperature during unoccupied winter hours may be reset for maximum energy savings. Provide new wiring and accessories as required.

B. Scope of Work

Gerber Village 100 Area single family houses (with basement), total of 36 units.

C. Quantities (per house)

1. 1,667 square feet of exterior wall.
2. 744 square feet of crawl space.
3. 3 fluorescent light fixtures.
4. One whole house fan.
5. One programmable thermostat.

D. Costs(*)

1. $5,241.60 per house.
2. $188,698 for the entire group.

*Costs shown include 6% for SIOH and 6% for Design Cost.

ECIP No. 3 Multiple ECOs for 166-171 Area

A. Description of Work

1. Blown-in insulation for first and second floor walls: Two holes would be drilled in each furring cavity of the exterior walls: one near the ceiling and one near the mid-point, for cellulose insulation to be blown in and fill the cavity. Holes will be patched by the insulation contractor, and refinished by the drywall contractor. The depth of cavities is approximately 1 inch.
2. Fiberglass insulation batts of R-19 insulating value (minimum) and with kraft paper backing would be installed between floor joists at crawl space. Insulation would be held in place with spring type wire fasteners. Average headroom in crawl space is 24 inches.
3. An average of three (3) existing incandescent light fixtures in each housing unit, which are used the most during occupied hours, would be replaced ceiling-mounted fluorescent light fixtures (with one 32-watt T-8 lamp). Existing switches and electrical wiring would be reused.
4. Install new whole house fans complete with new power wiring and controls (both thermostatic controls and fan speed controls).
5. Replace existing thermostats with electronic programmable type heating/cooling thermostats, so that space temperature during unoccupied winter hours may be reset for maximum energy savings. Provide new wiring and accessories as required.

B. Scope of Work

166-171 Area duplex houses, total of 12 units.

C. Quantities (per house)

1. 1,408 square feet of exterior wall.
2. 144 square feet of crawl space.
3. 3 fluorescent light fixtures.

4. One whole house fan.
5. One programmable thermostat.

D. Costs(*)

1. $4,785.76 per house.
2. $57,429 for the entire group.

*Costs shown include 6% for SIOH and 6% for Design Cost.

ECIP No. 4 Multiple ECOs for T-400 Area "T"-Shape Houses

A. Description of Work

1. An average of three (3) existing incandescent light fixtures in each housing unit, which are used the most during occupied hours, would be replaced ceiling-mounted fluorescent light fixtures (with one 32-watt T-8 lamp). Existing switches and electrical wiring would be reused.
2. Install new whole house fans complete with new power wiring and controls (both thermostatic controls and fan speed controls).
3. Replace existing thermostats with electronic programmable type heating/cooling thermostats, so that space temperature during unoccupied winter hours may be reset for maximum energy savings. Provide new wiring and accessories as required.
4. Provide fiberglass insulation for domestic water heaters in crawl space.

B. Scope of Work

T-400 Area "T"-shape single family houses, total of 20 units.

C. Quantities (per house)

1. 3 fluorescent light fixtures.
2. One whole house fan.
3. One programmable thermostat.
4. One domestic water heater.

D. Costs(*)

1. $1,669 per house.
2. $33,380 for the entire group.

*Costs shown include 6% for SIOH and 6% for Design Cost.

ECIP No. 5 Multiple ECOs for T-400 Area "L"-Shape Houses

A. Description of Work

1. Fiberglass insulation batts of R-19 insulating value (minimum) and with kraft paper backing would be installed between floor joists at crawl space. Insulation would be held in place with spring type wire fasteners. Average headroom in crawl space is 24 inches.

2. An average of three (3) existing incandescent light fixtures in each housing unit, which are used the most during occupied hours, would be replaced ceiling-mounted fluorescent light fixtures (with one 32-watt T-8 lamp). Existing switches and electrical wiring would be reused.
3. Install new whole house fans complete with new power wiring and controls (both thermostatic controls and fan speed controls).
4. Replace existing thermostats with electronic programmable type heating/cooling thermostats, so that space temperature during unoccupied winter hours may be reset for maximum energy savings. Provide new wiring and accessories as required.
5. Provide fiberglass insulation for domestic water heaters in crawl space.

B. Scope of Work

T-400 Area "L"-shape single family houses, total of 14 units.

C. Quantities (per house)

1. 2,020 square feet of crawl space.
2. 3 fluorescent light fixtures.
3. One whole house fan.
4. One programmable thermostat.
5. One domestic water heater.

D. Costs(*)

1. $3,365.60 per house.
2. $47,118 for the entire group.

*Costs shown include 6% for <u>SIOH</u> and 6% for <u>Design Cost</u>.

ECIP No. 6 <u>Replace 3 Incandescent Light Fixtrues with High Efficiency Fluorescent Type River Village 1600 Area</u>

A. Description of Work

1. An average of three (3) existing incandescent light fixtures in each housing unit, which are used the most during occupied hours, would be replaced ceiling-mounted fluorescent light fixtures (with one 32-watt T-8 lamp). Existing switches and electrical wiring would be reused.

B. Scope of Work

River Village 1600 Area, duplex houses, total of 188 units.

C. Quantities (per house)

1. 3 fluorescent light fixtures.

D. Costs(*)

1. $352.80 per house.
2. $66,326 for the entire group.

*Costs shown include 6% for SIOH and 6% for Design Cost.

ECIP No. 7 Install New Whole House Fans and Programmable Thermostats
River Village 1600 Area

A. Description of Work

1. Install new whole house fans complete with new power wiring and controls (both thermostatic controls and fan speed controls).
2. Replace existing thermostats with electronic programmable type heating/cooling thermostats, so that space temperature during unoccupied winter hours may be reset for maximum energy savings. Provide new wiring and accessories as required.
3. Provide fiberglass insulation for domestic water heaters in crawl space.

B. Scope of Work

River Village 1600 Area, duplex houses, total of 188 units.

C. Quantities (per house)

1. One whole house fan.
2. One programmable thermostat.

D. Costs(*)

1. $1,269 per house.
2. $238,564 for the entire group.

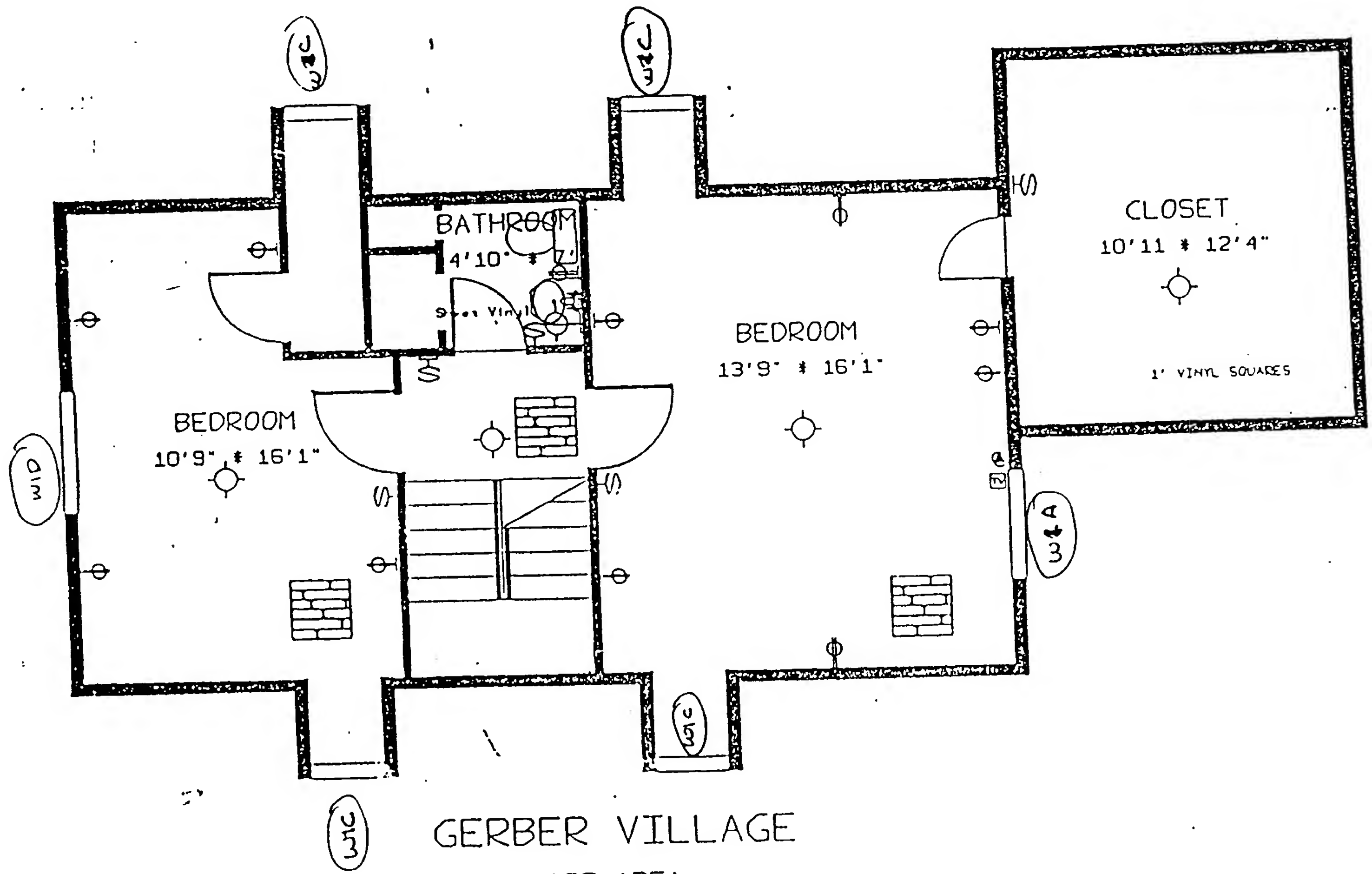
*Costs shown include 6% for SIOH and 6% for Design Cost.

High enough?

VI. Appendices

Appendix A

Building Audit Sheets



GERBER VILLAGE
100 AREA

2 STORY
4 BEDROOM
HOUSE

SECOND FLOOR
SCALE: 1" = 6'

A-1

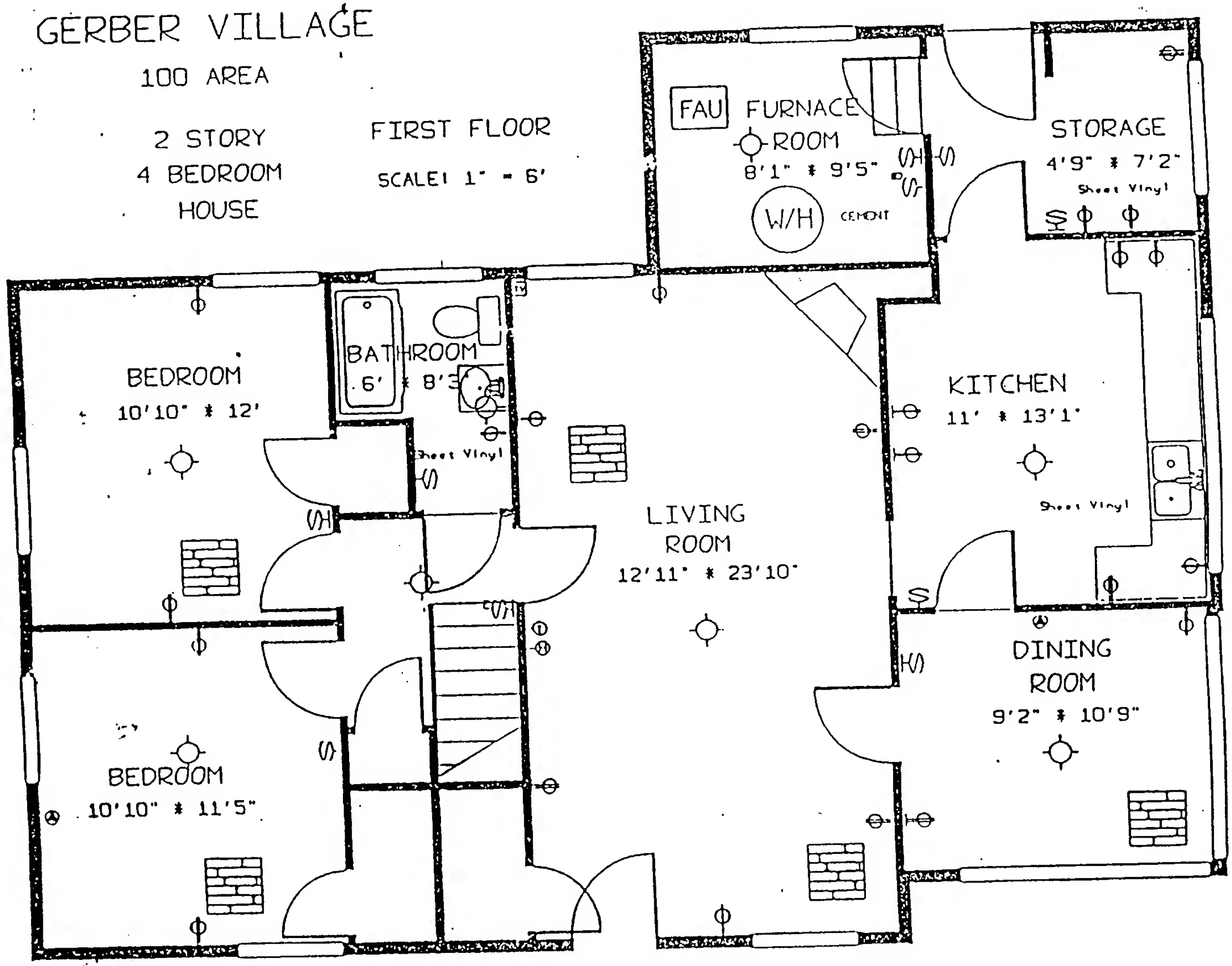
GERBER VILLAGE

100 AREA

2 STORY
4 BEDROOM
HOUSE

FIRST FLOOR

SCALE: 1" = 6'



A-2

Energy Conservation Opportunity Survey

Field Survey Form

Location Information
Subdivision 100 · Gerber
Unit No.

Geometry

	B	1	2	3
No of Floors				
Dist F to F				
Dist F to C				

Symbol Legend
◇ Wall Type
⬭ Opening Type
□ Note

Envelope Types

Exterior Walls

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Prob Constr	bv,wf,cav,conc,sm		Conc			
Ext Matl	wd,v,a,br,conc,	Brick	Conc	Vinyl		
Ins	rig,batt + thk		—			
Int Fin	pl,conc,mas	pl	Conc	pl		
Condition	g,f,p					
ECO	ins,vb,shade,bar					
Maint						

Floor

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	sog, cs.	crawl				
Fin	cpt,wd,ct,vy,con	~~wd~~				
Subfl	na,wd,comp,conc	wd				
Struc	wdfr, conc, stlfr	wd				
Ins	rig,batt + thk					
Ceiling	pl,non,conc,sts	—				
Condition	g,f,p					
ECO	ins,vb					
Maint						

Roof

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	f, h, gab, gam, m	gab	flat			
Covering	shing, sheet	shing	copper			
Color	l,d					
Deck	wd, mtl	wd				
Pitch	run:rise (x :12)	12:12				
Condition	g,f,p					
ECO	st, wstrip, insmtl					
Maint						

Attic

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Struc	wdfr, conc, stlfr	wd frame				
Ins	rig,batt + thk	blown in 16"				
Ceiling	pl,non,conc,sts	pl				
Condition	g,f,p	g				
ECO	v, ins, sh,inf					
Maint						

Date Surveyed____________
Surveyor Initials: FE

Energy Conservation Opportunity Survey

Field Survey Form

Opening Types

Windows

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	dh,sh,c,h,a,j,gb	dbl hung				
Operation	f, fdh, cwdh, cnk	Ctr Bal				
Material	wd, al, st, v	wd				
Glazing	1, 2, 3	1				
Divides	true, appl	T				
Size	w*h					
Frames	wd, al, v, st, hol	wd - hollow				
Storms	gl, pl, al, wd, st, v	al/gl 2				
Treatments	roll, sdr, odr, mbl, vbl					
Infiltration	low, high					
Condition	g,f,p	f				
ECO	strm, ws, dg, trim					
Maint						

Doors

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	fl, pan, sc, hol	Panelled				
Material	wd, mtl, gl, pl	mtl				
Ins	y,n	y				
Glazing Qty		2				
Glazing Size	w*h	7 x 5				
Glazing Pane	1, 2, 3	2				
Size	w*h	36 x 80				
Frames	wd, al, v, st, hol	wd				
Storm	gl, pl, al, wd, st, v	gl/al				
Infiltration	low, high					
Condition	g,f,p					
ECO	st, wstrip, insmtl					
Maint						

Vents

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	e, d, ga, br,scr, clg					
Material	wd, mtl					
Geometry	tri,sq,ci + w*h					
Frequency	spacing o.c.					
Screening						
Operation	fo, mao					
Fan Size	dia					
Fan spd	lo,hi					
Fan control	ts, man					
Condition	g,f,p					
ECO						
Maint						

Date Surveyed ____________

Surveyor Initials: FE

Field Survey Form

Heating Ventilation and Cooling

Heating Unit

		Zone 1	Zone 2	Zone 3
Type	fa,hyd,rad			
Fuel	g,o,e,w,c			
Mfr				
Model No				
Age				
Control	on/off,t var			
Condition	g,f,p			
ECO				
Maint				
Notes				

Cooling Unit

Type	fa,hyd,tw,non					
Fuel	g,e					
Mfr						
Model No						
Age						
Control	on/off,t var					
Condition	g,f,p					
ECO						
Maint						
Notes						

Distribution System

Type	fa,hyd					
Insulation	fg + thk					
Material						
Leakage						
Fixture	reg,rad,fc,op					
Condition	g,f,p					
ECO						
Maint						
Notes						

Humidification

Distribution	local,ducts					
Control	on/of,h var					
Condition	g,f,p					
ECO						
Maint						
Notes						

Hot Water Heater

Fuel		Age		Condition	
Mfr		Ins jacket		ECO	
Model		Pipe Ins		Maint	
				Notes	

Date Surveyed____________

Surveyor Initials: FE

Field Survey Form

Notes

1. Window Size Designations

A	34	54
B		
C	27	44
D	37	54
E		

2. All windows have storms designed to cover sash weight pockets

Date Surveyed ____________

Surveyor Initials: FE

GERBER VILLAGE -- 100 AREA
2 STORY 4 BEDROOM HOUSE WITH BASEMENT
58 UNITS

	UNIT	QUANTITY
FLOORING		
WOOD STRIP	SF	1224
SHEET VINYL	SF	143
ELECTRICAL		
CEILING FIXTURE	EA	12
WALL FIXTURE	EA	4
SINGLE RECEPTACLE OUTLET	EA	1
DUPLEX RECEPTACLE OUTLET	EA	24
TRIPLEX RECEPTACLE OUTLET	EA	1
SINGLE POLE SWITCH	EA	13
DOUBLE POLE SWITCH	EA	1
TRIPLE POLE SWITCH	EA	1
SWITCH & DUPLEX RECEPTACLE	EA	1
CIRCUIT BREAKER	EA	1
TELEPHONE OUTLET	EA	4
TELEVISION OUTLET	EA	2
THERMOSTAT	EA	1
HUMIDIFIER	EA	1

Energy Conservation Opportunity Survey

Field Survey Form

Ft Belvoir Housing ECO
EYP Project No. 60592.00

Location Information	
Subdivision	GERBER
Unit No.	138

Geometry	B	1	2	3
No of Floors	B	1	2	3
Dist F to F	8'7	9'10	—	
Dist F to C	7'6	8'10		

Symbol Legend	
◇	Wall Type
⬭	Opening Type
☐	Note

Envelope Types

Exterior Walls

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Prob Constr	bv,wf,cav,conc,sm		conc			
Ext Matl	wd,v,a,br,conc,	brick	conc	Vinyl		
Ins	rig,batt + thk		—			
Int Fin	pl,conc,mas	pl	conc	pl		
Condition	g,f,p	g	g	g		
ECO	ins,vb,shade,bar		48" rigid			
Maint						

Floor

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	sog, cs,	36" crawl sp	~~[illegible]~~ wdfr	slab on grade sog		
Fin	cpt,wd,ct,vy,con	varies	varies	conc		
Subfl	na,wd,comp,conc	wd	wood	—		
Struc	wdfr, conc, stlfr	wd fr 2x10	wd fr 2x10	—		
Ins	rig,batt + thk	none	—	—		
Ceiling	pl,non,conc,sts	—	lath & stucco	—		
Condition	g,f,p	g	f	f		
ECO	ins,vb	ins				
Maint						

Notes

Roof

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	f, h, gab, gam, m	gab	flat			
Covering	shing, sheet	shing	mtl/copper			
Color	l,d	l	green patina			
Deck	wd, mtl	wd				
Pitch	run:rise (x :12)	12:12				
Condition	g,f,p	g	f			
ECO	st, wstrip, insmtl					
Maint						

Attic

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Struc	wdfr, conc, stlfr	wdfr				
Ins	rig,batt + thk	bi 16"				
Ceiling	pl,non,conc,sts	pl/gwb				
Condition	g,f,p	g				
ECO	v, ins, sh,inf					
Maint						

Date Surveyed 10·21·93

Surveyor Initials: FE

Energy Conservation Opportunity Survey

Field Survey Form

Opening Types

Windows

	Options	Type ~~1~~ 1	Type 2 ~~2~~	Type 3	Type 4	Type 5
Type	dh,sh,c,h,a,j,gb	horiz · slide	DH		DH	
Operation	f, fdh, cwdh, cnk		~~…~~ Canter bal		friction	
Material	wd, al, st, v	st	wd		wd	
Glazing	1, 2, 3	2	1		1	
Divides	true, appl	T	T		t	
Size	w*h	36 * ~~…~~ 18	$\boxed{3}$		35 57	
Frames	wd, al, v, st, hol	st	wd - hollow		wd	
Storms	gl, pl, al, wd, st, v	—	al / gl		al / gl	
Treatments	roll, sdr, odr, mbl, vbl	~~…~~	v roll scr		v roll scr	
Infiltration	low, high					
Condition	g,f,p	g	f		g	
ECO	strm, ws, dg, trim					
Maint						

$\boxed{6}$

Doors

	Options					
Type	fl, pan, sc, hol	Panneled				
Material	wd, mtl, gl, pl	mtl				
Ins	y,n	y				
Glazing Qty		2				
Glazing Size	w*h	7 * 5				
Glazing Pane	1, 2, 3	2				
Size	w*h	36 * 80				
Frames	wd, al, v, st, hol	wd				
Storm	gl, pl, al, wd, st, v	al / gl				
Infiltration	low, high					
Condition	g,f,p	g				
ECO	st, wstrip, insmtl					
Maint		$\boxed{5}$				

Vents

	Options					
Type	e, d, ga, br,scr, clg	BR	Gable	Gable	Br	clg / wh
Material	wd, mtl	mtl				
Geometry	tri,sq,ci + w*h	sq 12 * 4	tri 96 * 48	tri 16 x 8	sq 12 * 8	sq 48x48
Frequency	spacing o.c.	2 ea side	1	1	1	1
Screening		y	y	y	—	N
Operation	fo, mao	fixed open	fixed open	fixed open	~~B~~ —	mao
Fan Size	dia	—	—	—	—	44
Fan spd	lo,hi	—	—	—	—	1700 rpm
Fan control	ts, man	—	—	—	—	man
Condition	g,f,p	g	g	g	—	f
ECO					$\boxed{4}$	
Maint					$\boxed{4}$	$\boxed{1}$

Date Surveyed 10·21·93

Surveyor Initials: FE

Field Survey Form

Heating Ventilation and Cooling

Heating Unit

		Zone 1	Zone 2	Zone 3	
Type	fa,hyd,rad	fa			
Fuel	g,o,e,w,c	g			
Mfr		Trane			
Model No		XL90 $\boxed{2}$			
Age		5 yrs			
Control	on/off,t var on/of	t stat			
Condition	g,f,p				
ECO					
Maint					
Notes					

Cooling Unit

Type	fa,hyd,tw,non					
Fuel	g,e					
Mfr						
Model No						
Age						
Control	on/off,t var					
Condition	g,f,p					
ECO						
Maint						
Notes						

Distribution System

Type	fa,hyd	fa				
Insulation	fg + thk					
Material						
Leakage						
Fixture	reg,rad,fc,op	reg				
Condition	g,f,p	g				
ECO						
Maint						
Notes						

Humidification

Distribution	local,ducts	d				
Control	on/of,h var	on/of h var				
Condition	g,f,p	g				
ECO						
Maint						
Notes						

Hot Water Heater

Fuel	g	Age		Condition	g	
Mfr	AO Smith	Ins jacket	n	ECO		
Model	PGH 40 982	Pipe Ins	y 1"	Maint		
				Notes		

Date Surveyed 10-21-93

Surveyor Initials: FE

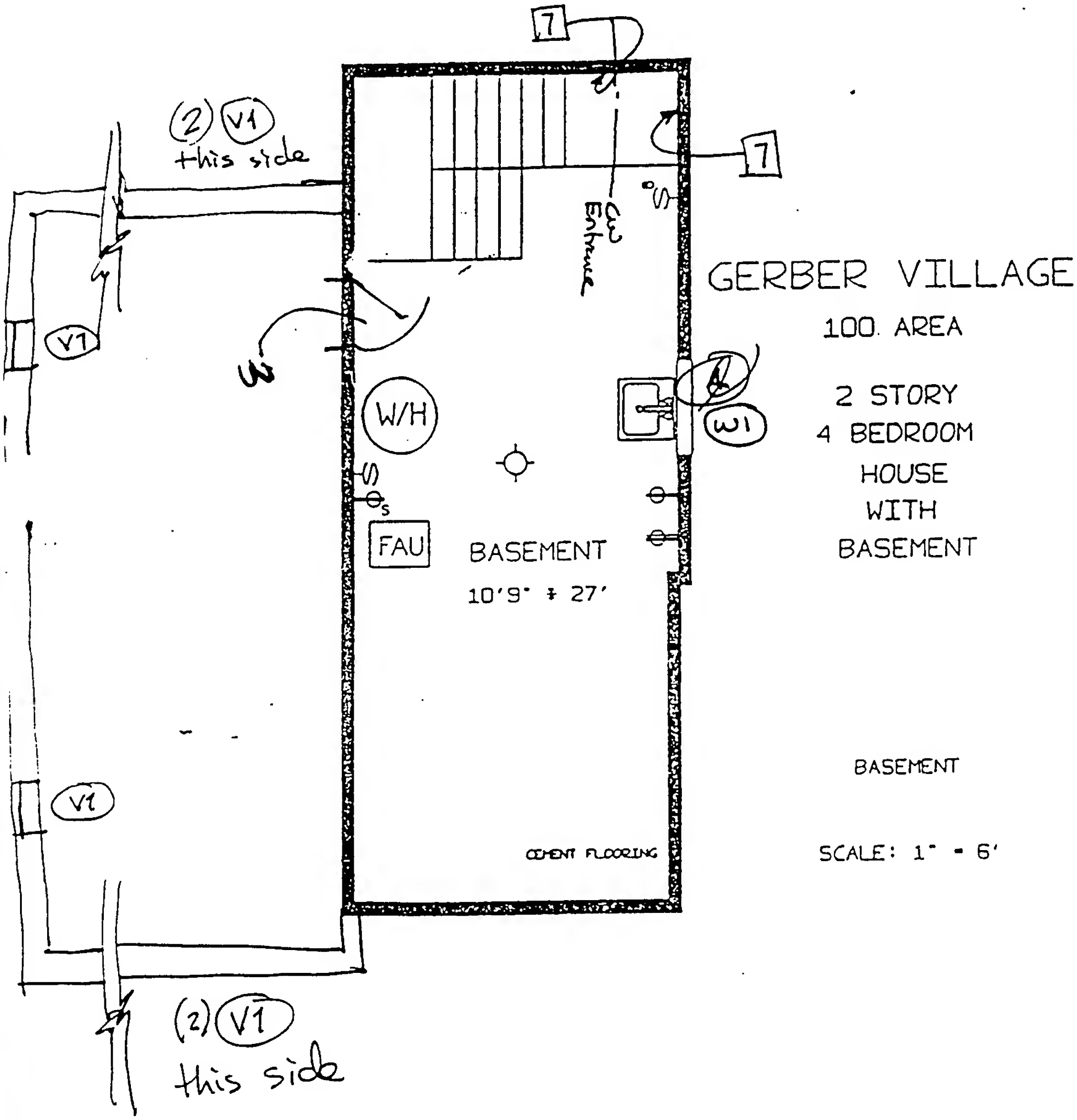
Notes

1. Check operation @ unit 138
2. Trane Model BLO100K948B3
3. Window type & size designations

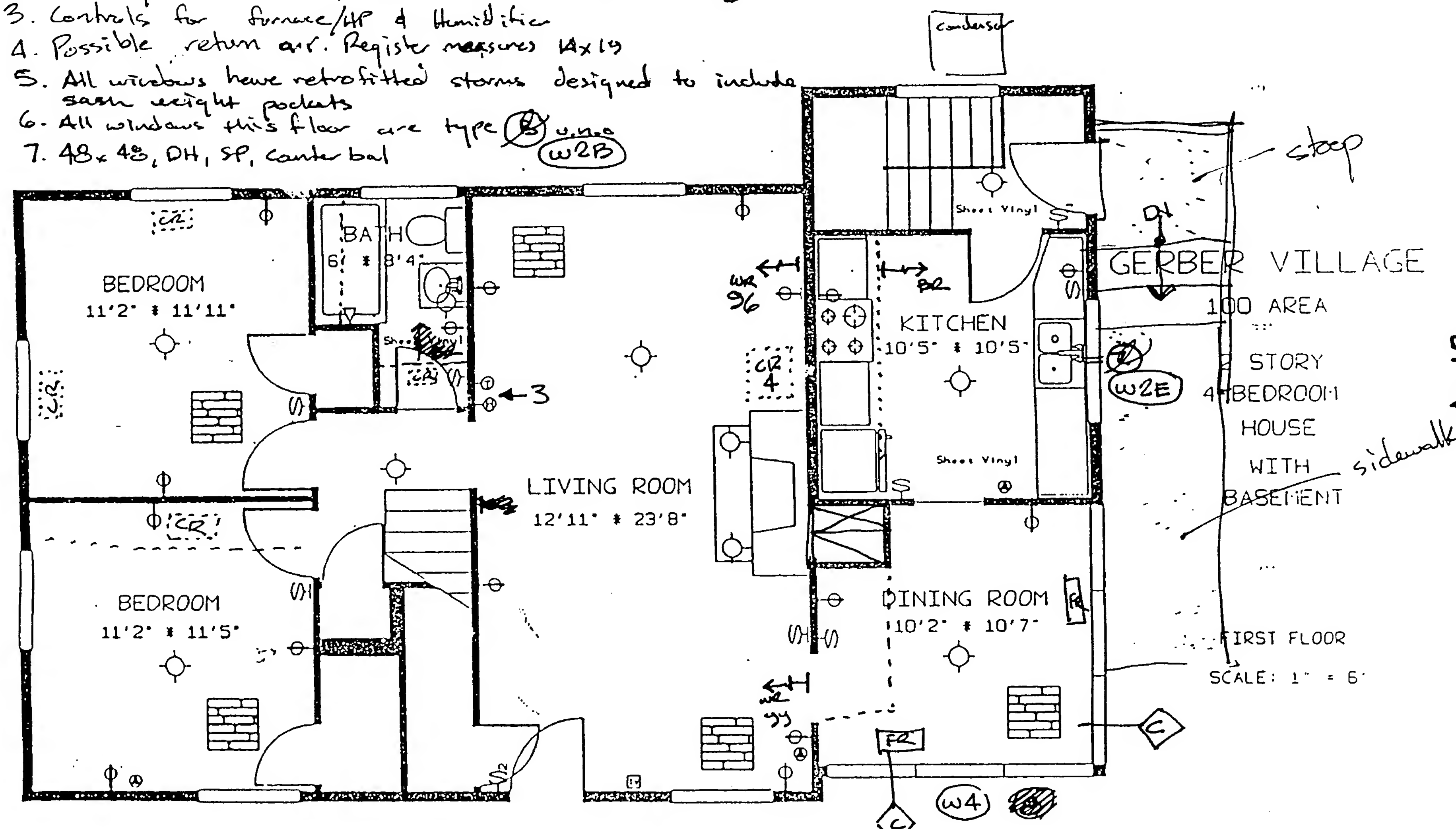
	w	h
A	34	54
B	37	64
C	27	44
D	37	54
E	48	48

4. Vent has been blocked w/ brick. Ventillation of attic space could relieve summer heat build-up.
5. Front storm door needs felt weather stripping on all sides. Side storm door needs felt ws on top. Side entry door needs latch side ws replaced
6. 1/2 of window is glass, the other plywood panel for dryer duct
7. Basements Flood.
   Wall stains found on interior walls as indicated. Sidewalk adjacent to stoop has no expansion joint. Grade above water service entrance slopes slightly towards building.

1. Floor is type C
2. Walls B
3. Crawl space Access



1. Wall type is (A) u.n.o.
2. Floor type is A except ober basement which is B
3. Controls for furnace/HP & Humidifier
4. Possible return air. Register measures 14x19
5. All windows have retrofitted storms designed to include sash weight pockets
6. All windows this floor are type (B) u.n.o (W2B)
7. 48x48, DH, SP, center bal



8. 35x57 DH, SP, FRICTION travel

[FR] FLOOR REGISTER

→BR [BR] - BULKEAD REGISTER

→WR [WR] 96 WALL REGISTER w/ Ht. TO ℄ INDICATED

1. entire upstairs wall type is R (roof) except dormer walls which are C u.n.o.
2. Dormer windows are type ~~C~~. W2C
3. 34x54 DH, SP, CB W2A
4. see note 5. on First Fl.
5. Attic Access hatch
6. ~~Whole~~ House attic fan may not work.

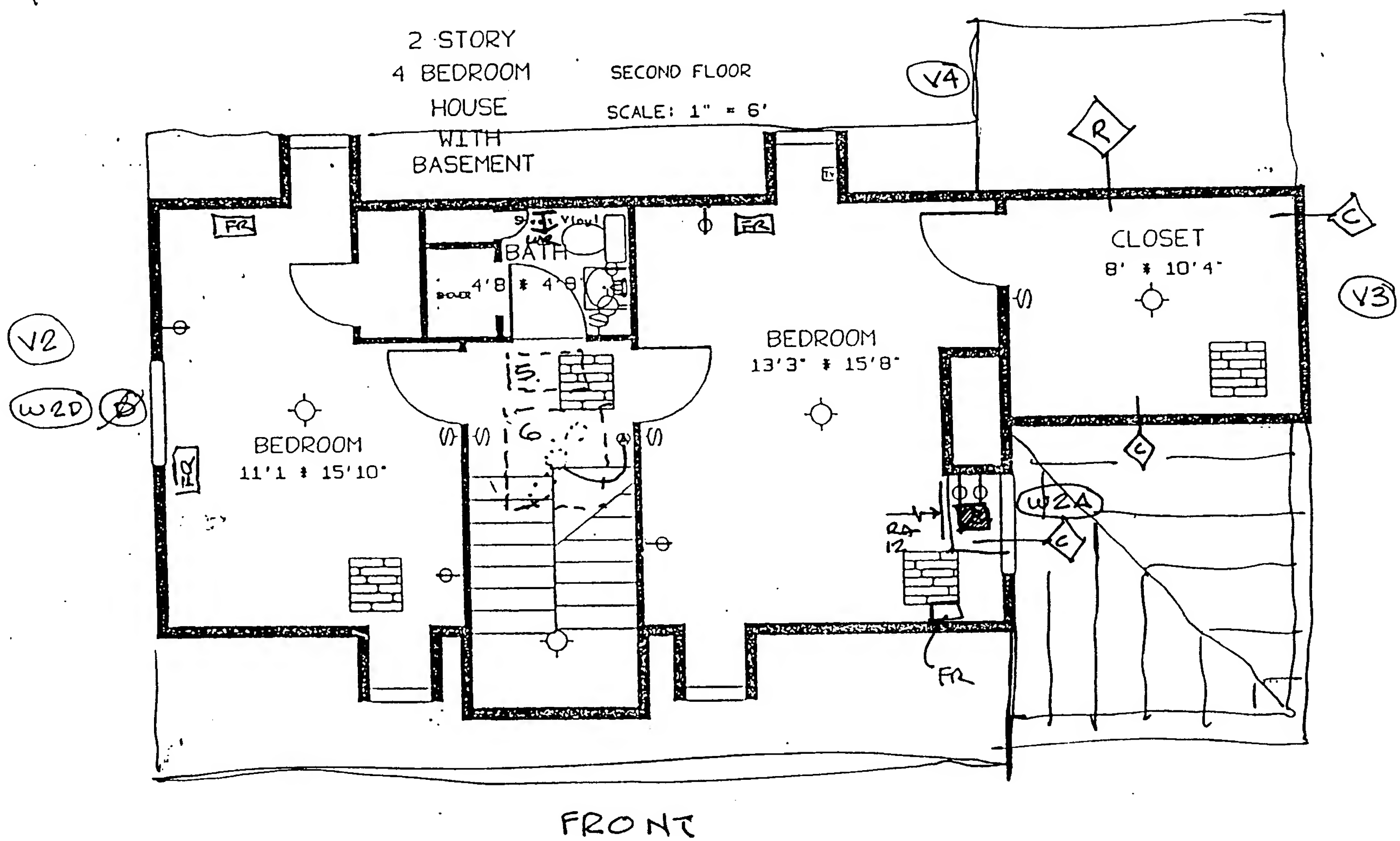
GERBER VILLAGE

100 AREA

2 STORY
4 BEDROOM
HOUSE
WITH
BASEMENT

SECOND FLOOR

SCALE: 1" = 6'



A-14

Gerber 129 - Joanie

- basements leaks - rain & using spigots
- walls cold
- windows fine.
- attic fans have been disconnected in most units except this one
- front door drafts slightly
- Unbalanced air - upstairs cold, basements Cold
- Crawl space access leaks air into basements.

RIVER VILLAGE -- 1600 AREA
2 STORY 3 BEDROOM TOWNHOUSE
188 UNITS

	UNIT	QUANTITY
FLOORING		
WOOD STRIP	SF	376
SHEET VINYL	SF	227
PARQUET	SF	557
ELECTRICAL		
CEILING FIXTURE	EA	14
WALL FIXTURE	EA	2
DUPLEX RECEPTACLE OUTLET	EA	26
TRIPLEX RECEPTACLE OUTLET	EA	1
QUADRUPLE RECEPTACLE OUTLET	EA	1
SINGLE POLE SWITCH	EA	11
TRIPLE POLE SWITCH	EA	2
CIRCUIT BREAKER	EA	1
TELEPHONE OUTLET	EA	3
THERMOSTAT	EA	1

Energy Conservation Opportunity Survey

Field Survey Form

Ft Belvoir Housing ECO
EYP Project No. 60592.00

Location Information

Subdivision RIVER VILL

Unit No. 1609

Geometry

	B	1	2	3
No of Floors				
Dist F to F				
Dist F to C		7 10	8 0	

Symbol Legend

Wall Type

Opening Type

Note

Envelope Types

Exterior Walls

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Prob Constr	bv,wf,cav,conc,sm	wf / bv	wf			
Ext Matl	wd,v,a,br,conc,	br	wd /			
Ins	rig,batt + thk	batt 3 1/2	batt 3 1/2			
Int Fin	pl,conc,mas	gwb	gwb			
Condition	g,f,p	f	f			
ECO	ins,vb,shade,bar					
Maint						

Notes 1

Floor

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	sog, cs,	Crawl Space				
Fin	cpt,wd,ct,vy,con					
Subfl	na,wd,comp,conc	wd				
Struc	wdfr, conc, stlfr	wdfr				
Ins	rig,batt + thk	batt 4" ±				
Ceiling	pl,non,conc,sts	—				
Condition	g,f,p	g				
ECO	ins,vb					
Maint						

Notes

Roof

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	f, h, gab, gam, m	gab				
Covering	shing, sheet	shing				
Color	l,d	l				
Deck	wd, mtl	wd				
Pitch	run:rise (x :12)	6:12				
Condition	g,f,p	p				
ECO	st, wstrip, insmtl					
Maint						

Notes

Attic

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Struc	wdfr, conc, stlfr	wdfr				
Ins	rig,batt + thk	batt+sp 6"				
Ceiling	pl,non,conc,sts	gwb				
Condition	g,f,p	g				
ECO	v, ins, sh,inf					
Maint						

Notes

Page 1

Date Surveyed 27 Oct 93

Surveyor Initials: FE

Opening Types

Windows

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	dh,sh,c,h,a,j,gb	Dh				pic
Operation	f, fdh, cwdh, cnk	fdh				fxd
Material	wd, al, st, v	wd/gl				wd/gl
Glazing	1, 2, 3	1				1
Divides	true, appl	t				t
Size	w*h	6				16 x 6⁵
Frames	wd, al, v, st, hol	wd/al				w
Storms	gl, pl, al, wd, st, v	al, sc, gl				al/gl
Treatments	roll, sdr, odr, mbl, vbl	non				vr
Infiltration	low, high					
Condition	g,f,p	f				
ECO	strm, ws, dg, trim	dg/ws				
Maint						
		7				

Doors

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	fl, pan, sc, hol	fl/sc	pan	pan		
Material	wd, mtl, gl, pl	w	w/gl	m/gl		
Ins	y,n			Y		
Glazing Qty		–	3	1		
Glazing Size	w*h	–	28x12	20x32		
Glazing Pane	1, 2, 3	–	1	1		
Size	w*h	3⁰ 6⁸	2⁸ 6⁸	3⁰ 6⁸		
Frames	wd, al, v, st, hol	w	w	wd		
Storm	gl, pl, al, wd, st, v	gl, al	al, gl	al, gl		
Infiltration	low, high					
Condition	g,f,p			f		
ECO	st, wstrip, insmtl	ws	ws	ws		
Maint						
Notes		2 7	7	7		

Vents

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	e, d, ga, br,scr, clg	br	dryer	eave	gable	stove
Material	wd, mtl	m	al	mtl	mtl	al
Geometry	tri,sq,ci + w*h	sq/16x8	sq/4x4	sq/12x6	tri/6⁰ x 18	sq/12x3
Frequency	spacing o.c.	1/side	–	2 front 3 back	1/unit	1/unit
Screening		Y		–	Y	–
Operation	fo, mao	fo	fo	fo	fo	~~mao~~
Fan Size	dia	–	–	–	–	–
Fan spd	lo,hi	–	–	–	–	–
Fan control	ts, man	–	–	–	–	–
Condition	g,f,p	f	f	f	f	p
ECO						
Maint						
						5

Notes

Date Surveyed_______________

Surveyor Initials: FE

Heating Ventilation and Cooling

Heating Unit

		Zone 1	Zone 2	Zone 3
Type	fa,hyd,rad	forced air		
Fuel	g,o,e,w,c	g		
Mfr		Lennox		
Model No		G10		
Age		11 years		
Control	on/off,t var	o/o tstat		
Condition	g,f,p	f		
ECO				
Maint				
Notes				

replace

Cooling Unit

Type	fa,hyd,tw,non					
Fuel	g,e					
Mfr		Lennox				
Model No						
Age		11 yrs				
Control	on/off,t var	o/o tstat				
Condition	g,f,p	f				
ECO						
Maint						
Notes						

Distribution System

Type	fa,hyd	fa				
Insulation	fg + thk	fg 1"				
Material		metal				
Leakage						
Fixture	reg,rad,fc,op	reg				
Condition	g,f,p	g				
ECO						
Maint						
Notes						

Humidification

Distribution	local,ducts	d				
Control	on/of,h var	—				
Condition	g,f,p	f				
ECO						
Maint						
Notes						

Hot Water Heater

Fuel	Gas	Age	< 3 yrs	Condition	g
Mfr	Vanguard	Ins jacket	no	ECO	
Model	6E705	Pipe Ins	no	Maint	
				Notes	

Date Surveyed____________

Surveyor Initials: FE

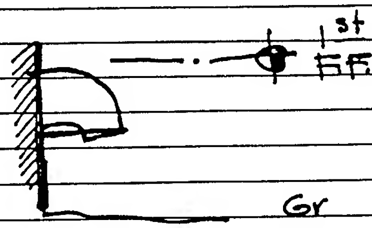
Notes

1. ~~[illegible]~~ Sheathing is plywood w/ bldg paper. Found missing siding piece.

2. Mail Slot in door.

3. From just below lower floor joist bottoms to underside of eave.

4. Ext duct.
   gas entrance.



5. Gravity ~~[illegible]~~ op door on outside w/ foam w/strip. Most ill fit

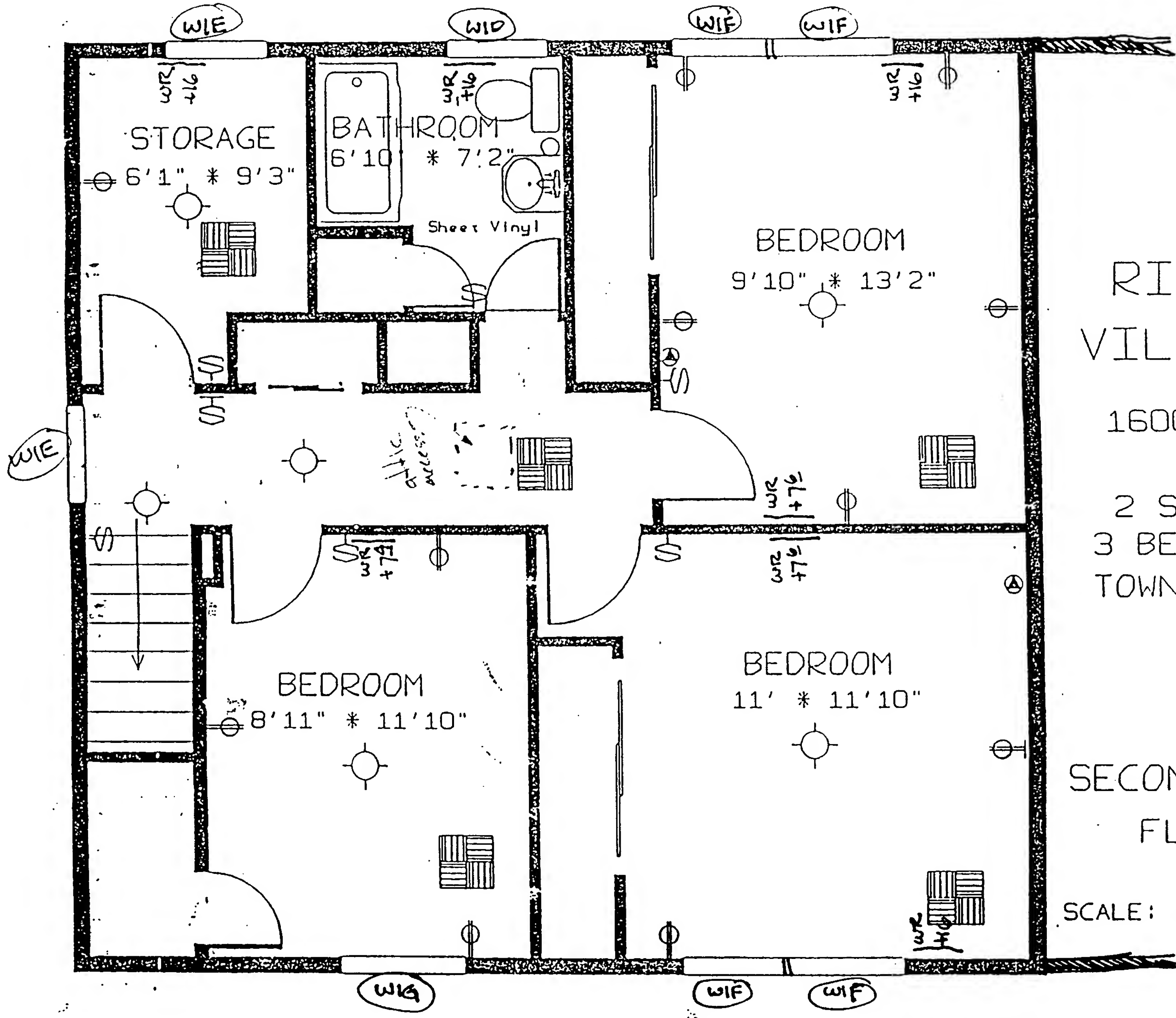
6. Size Varies: See T.480 ~~Notes~~ for legend
   - A 31 x 44
   - B 31 x 54
   - C 19 x 37
   - D 27 x 37
   - E 27 x 44
   - F 31 x 44
   - G 36 x 44

7. Weatherstrip types
   - D1 & D2 - spring
   - D3 plastic
   - Storms need felt

8. Fitties or [illegible] Fans — is this true?

Date Surveyed______________

Surveyor Initials: FE



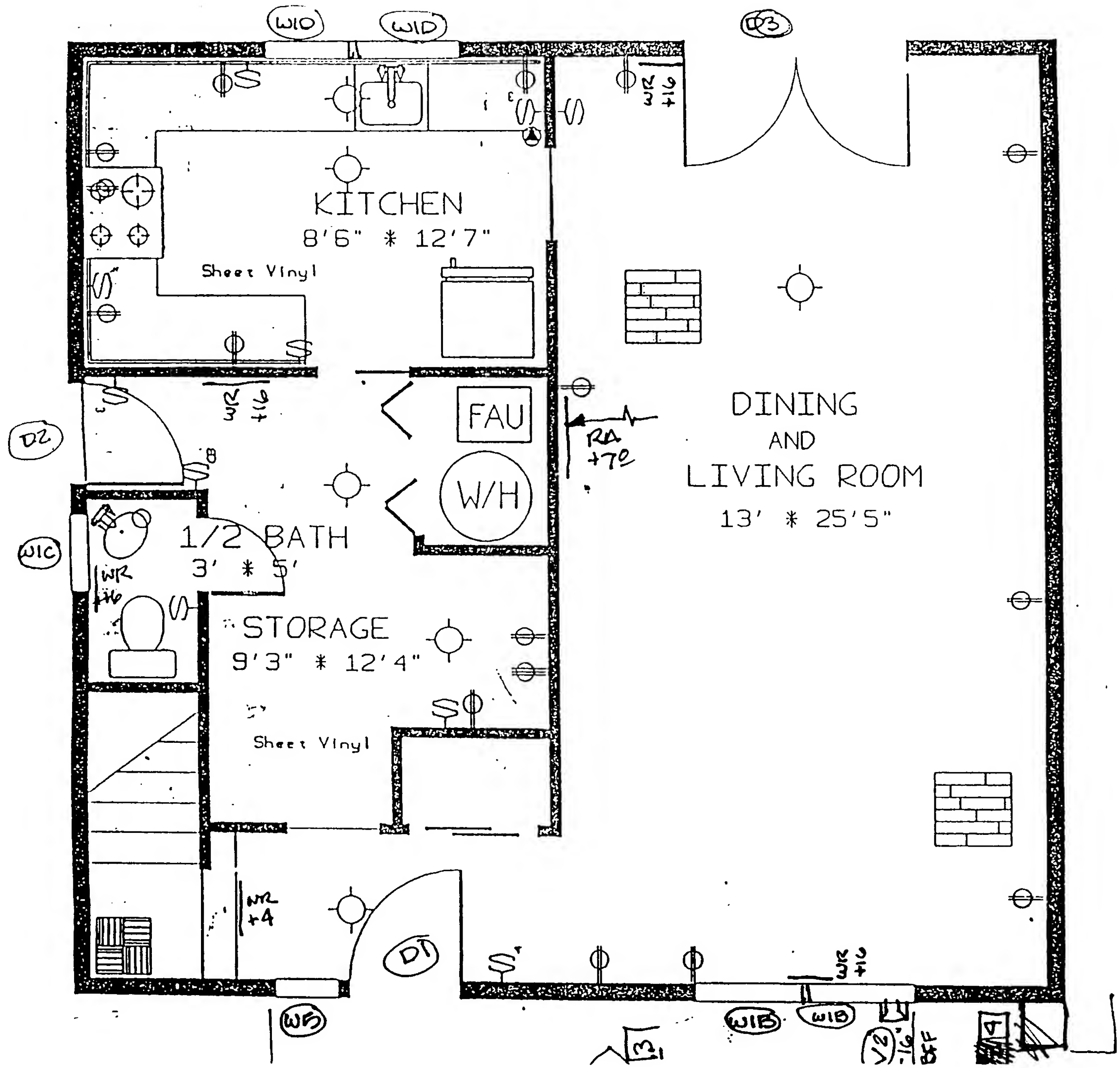
RIVER VILLAGE

1600 AREA

2 STORY
3 BEDROOM
TOWNHOUSE

SECOND
FLOOR

SCALE: 1" = 4'



RIVER VILLAGE

1600 AREA

2 STORY
3 BEDROOM
TOWNHOUSE

FIRST FLOOR

SCALE: 1" = 4'

Attic ECOs. air leakage into heated space

chims

cold walls

Overhangs

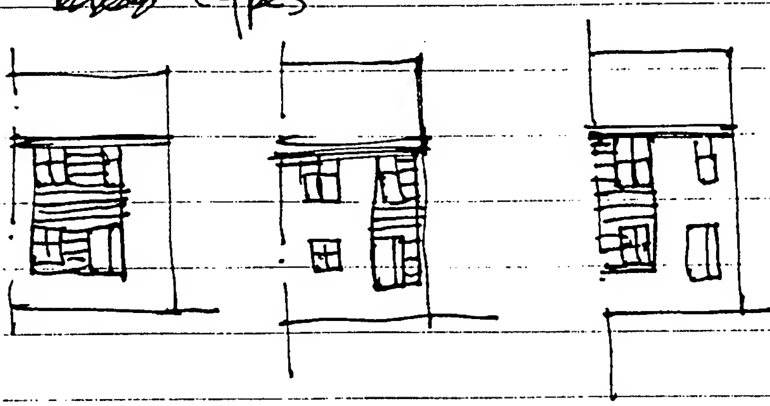
shade conditions

Lighting

W/S type spring / felt / plastic

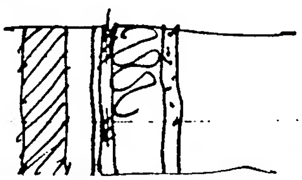
RVill (1) Vacancies 1631B, 1654B, 1687A, 1694B
1630B, 1657B

(2) wall ~~Floor~~ Types



(3) Wash Village - whole neighborhood renovations: replacement of hood vents - leaves exterior wall open for observation. Wall composition:

5*2=10*3=30-6
26.6
13.3
1:2
6:12



face brick
2½" air space
30lb. felt
½" sheathing
2x4

A-2

RIVER VILLAGE TENANT VIEW

A G E N D A

1. Cold walls
2. Drafty Windows & Doors
3. Air Balance
4. Attic Fans
5. Stove Vents - leakage?

R E S U L T S

1. No
2. Yes. One resident has installed draft stopping (stuffed insulation @ [redacted] sash edges.) Door & Window Openings not square according to one.
3. Upper floor stays warm during summer. Many resort to fans to circulate air.
4. Not present
5. Not noticable
6. most Outlets not grounded. Relevance?

166-171 AREA -- 3 STORY 3 BEDROOM TOWNHOUSE
12 UNITS

	UNIT	QUANTITY
FLOORING		
WOOD STRIP	SF	829
SHEET VINYL	SF	250
ELECTRICAL		
CEILING FIXTURE	EA	13
LIGHT FIXTURE WITH PULL CHAIN	EA	2
WALL FIXTURE	EA	5
SINGLE RECEPTACLE OUTLET	EA	1
DUPLEX RECEPTACLE OUTLET	EA	24
TRIPLEX RECEPTACLE OUTLET	EA	1
SINGLE POLE SWITCH	EA	17
DOUBLE POLE SWITCH	EA	3
TELEPHONE OUTLET	EA	4
TELEVISION OUTLET	EA	3
THERMOSTAT	EA	1
HUMIDIFIER	EA	1

Energy Conservation Opportunity Survey
Field Survey Form

Ft Belvoir Housing ECO
EYP Project No. 60592.00

Location Information
Subdivision 161 - 144
Unit No.

Geometry

	B	1	2	3
No of Floors				
Dist F to F		9º	9²	
Dist F to C		8º	8²	

Symbol Legend
◇ Wall Type
○ Opening Type
□ Note

Envelope Types

Exterior Walls

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Prob Constr	bv,wf,cav,conc,sm	Solid Mas				
Ext Matl	wd,v,a,br,conc,	brick				
Ins	rig,batt + thk					
Int Fin	pl,conc,mas	plaster				
Condition	g,f,p					
ECO	ins,vb,shade,bar					
Maint						

Floor

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	sog, cs,	slab on gr	crawl space			
Fin	cpt,wd,ct,vy,con					
Subfl	na,wd,comp,conc	—	conc			
Struc	wdfr, conc, stlfr	conc	conc			
Ins	rig,batt + thk	—				
Ceiling	pl,non,conc,sts	—	—			
Condition	g,f,p					
ECO	ins,vb					
Maint						
		2	2			

Roof

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	f, h, gab, gam, m	Gable	flat			
Covering	shing, sheet					
Color	l,d					
Deck	wd, mtl	wd	wd			
Pitch	run:rise	12:9	12:1			
Condition	g,f,p					
ECO	st, wstrip, insmtl					
Maint						
			3			

Attic

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Struc	wdfr, conc, stlfr	wd frame				
Ins	rig,batt + thk					
Ceiling	pl,non,conc,sts	plast				
Condition	g,f,p					
ECO	v, ins, sh,inf					
Maint						

Date Surveyed__________

Surveyor Initials: FE

Opening Types

Windows

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	dh,sh,c,h,a,j,gb	dbl hung	hopper			
Operation	f, fdh, cwdh, cnk	ctr wt				
Material	wd, al, st, v	wd				
Glazing	1, 2, 3	1				
Divides	true, appl	+				
Size	w*h					
Frames	wd, al, v, st, hol	wd				
Storms	gl, pl, al, wd, st, v					
Treatments	roll, sdr, odr, mbl, vbl					
Infiltration	low, high					
Condition	g,f,p					
ECO	strm, ws, dg, trim					
Maint						

Doors

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	fl, pan, sc, hol					
Material	wd, mtl, gl, pl					
Ins	y,n					
Glazing Qty						
Glazing Size	w*h					
Glazing Pane	1, 2, 3					
Size	w*h					
Frames	wd, al, v, st, hol					
Storm	gl, pl, al, wd, st, v					
Infiltration	low, high					
Condition	g,f,p					
ECO	st, wstrip, insmtl					
Maint						

Vents

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	e, d, ga, br,scr, clg	Gable				
Material	wd, mtl	wd				
Geometry	tri,sq,ci + w*h	sq 16 x 48				
Frequency	spacing o.c.	2				
Screening						
Operation	fo, mao					
Fan Size	dia					
Fan spd	lo,hi					
Fan control	ts, man					
Condition	g,f,p					
ECO						
Maint						

Date Surveyed ____________

Surveyor Initials: FE

Field Survey Form

Notes

1. [redacted] Window Size Designations

A $3^{5} \times 4^{2}$

B $3^{5} \times 5^{8}$

C $1^{3} \times 5^{8}$

D $2^{0} \times 5^{8}$

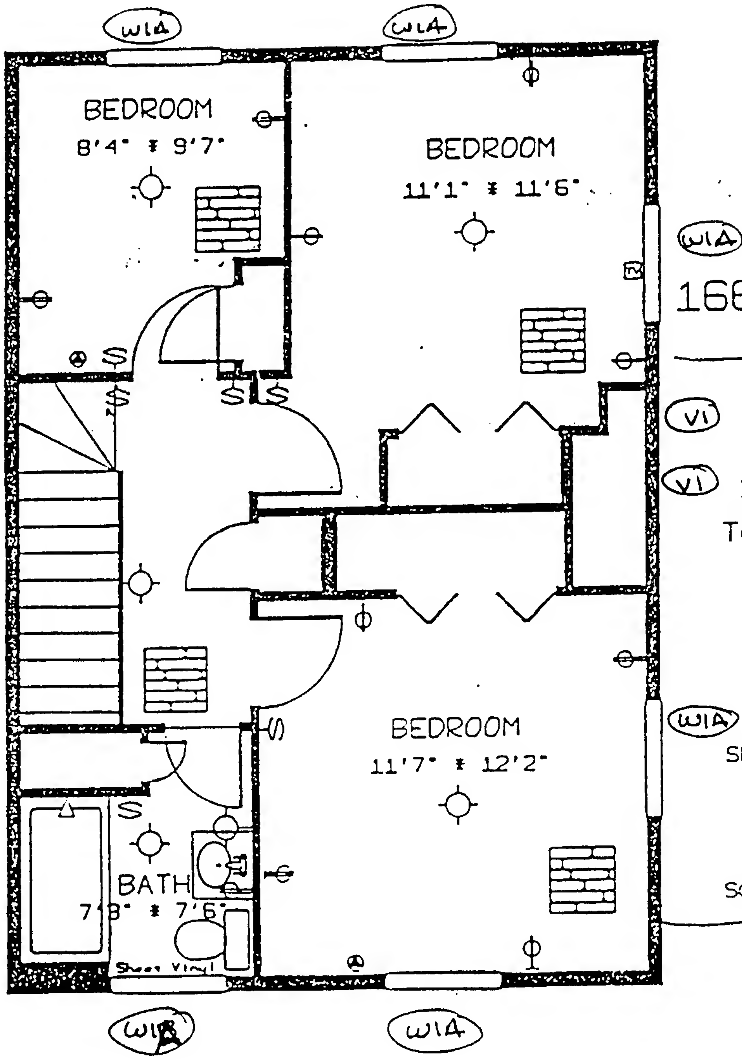
E

[redacted]F

2. Crawl space under sun porch. slab on grade basement everywhere else.

Date Surveyed______________

Surveyor Initials: FE



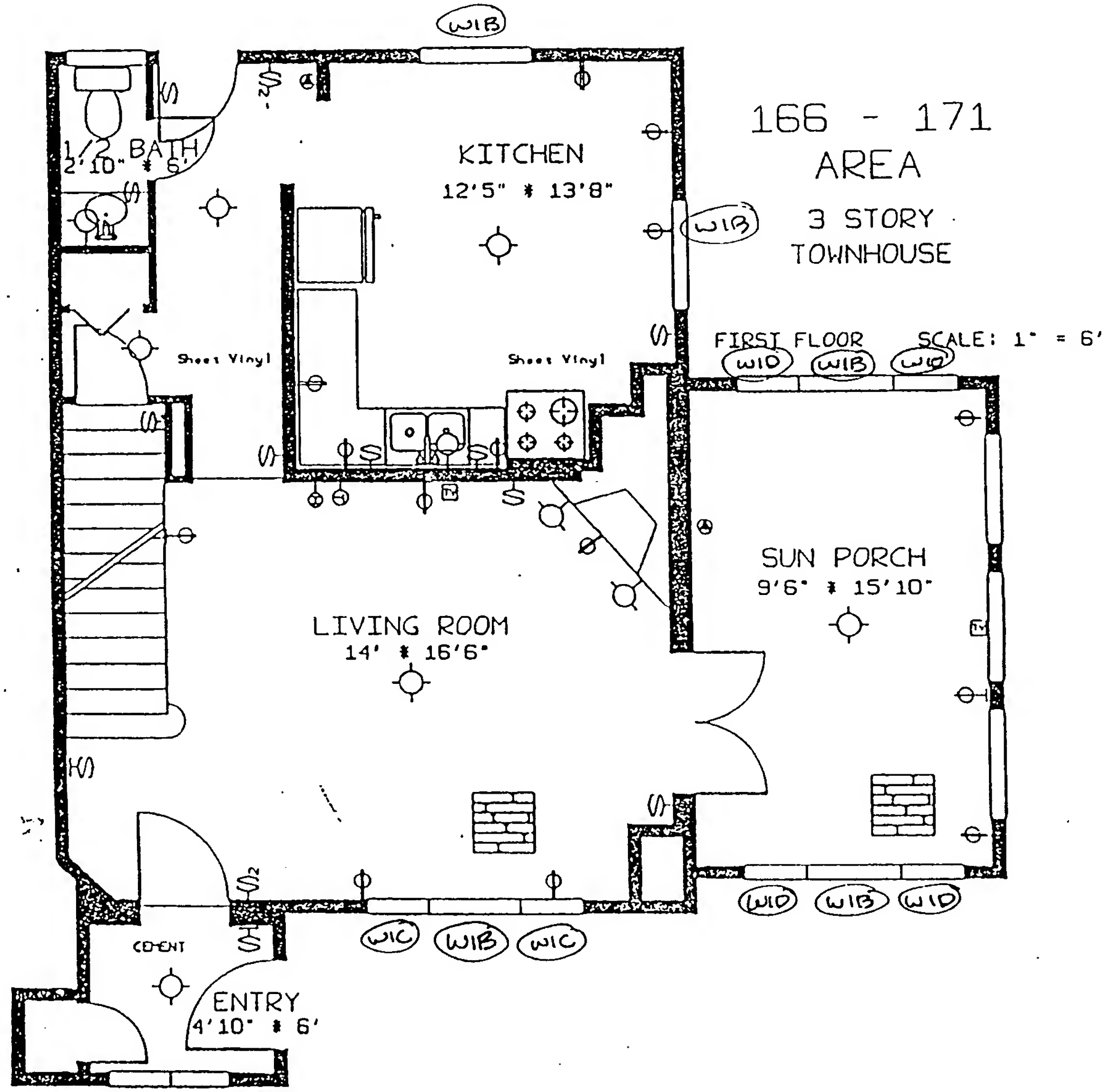
166 - 171

~~AREA~~

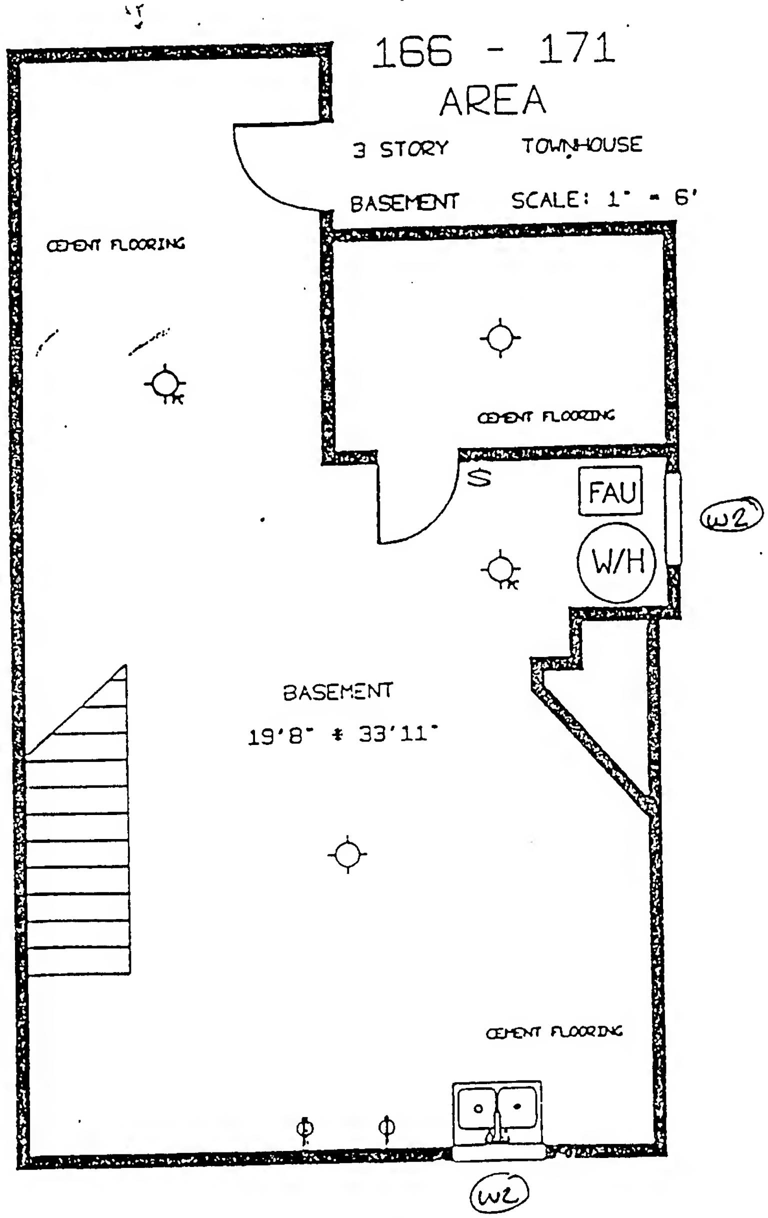
3 STORY
TOWNHOUSE

SECOND FLOOR

SCALE: 1" = 6'


166 - 171
AREA
3 STORY
TOWNHOUSE
FIRST FLOOR
SCALE: 1" = 6'
KITCHEN
12'5" * 13'8"
1/2 BATH
2'10" * 6'
Sheet Vinyl
Sheet Vinyl
LIVING ROOM
14' * 16'6"
SUN PORCH
9'6" * 15'10"
ENTRY
4'10" * 6'
CEMENT
WIB
WIB
WID
WIB
WID
WIC
WIB
WIC
WID
WIB
WID

A-30


166 - 171
AREA
3 STORY TOWNHOUSE
BASEMENT SCALE: 1" = 6'
CEMENT FLOORING
CEMENT FLOORING
S
FAU
W/H
w2
BASEMENT
19'8" * 33'11"
CEMENT FLOORING
w2

AREA -- 1 STORY 3 BEDROOM HOUSE
"T" SHAPE
20 UNITS

	UNIT	QUANTITY
FLOORING		
WOOD STRIP	SF	1182
SHEET VINYL	SF	327
CERAMIC TILE	SF	42
ELECTRICAL		
CEILING FIXTURE	EA	9
WALL FIXTURE WITH SINGLE OUTLET	EA	2
WALL FIXTURE WITH PULL CHAIN	EA	3
DUPLEX RECEPTACLE OUTLET	EA	27
TRIPLEX RECEPTACLE OUTLET	EA	1
QUADRUPLEX RECEPTACLE OUTLET	EA	1
SINGLE POLE SWITCH	EA	9
DOUBLE POLE SWITCH	EA	3
CIRCUIT BREAKER	EA	1
TELEPHONE OUTLET	EA	6
TELEVISION OUTLET	EA	1
THERMOSTAT	EA	2

Energy Conservation Opportunity Survey

Field Survey Form

Ft Belvoir Housing ECO
EYP Project No. 60592.00

Location Information

Subdivision 400 AREA
Unit No. T. 480
T. 468

Geometry

No of Floors	B	1	2	3
Dist F to F				
Dist F to C		9'0		

Symbol Legend

◇ Wall Type
⬭ Opening Type
☐ Note

Envelope Types

Exterior Walls

Exterior Walls	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Prob Constr	bv,wf,cav,conc,sm	wood frame	conc			
Ext Matl	wd,v,a,br,conc,	vinyl siding	conc			
Ins	rig,batt + thk		–			
Int Fin	pl,conc,mas	plast or gwb	conc			
Condition	g,f,p	g	g			
ECO	ins,vb,shade,bar					
Maint						

4

Floor

crawl space 24" $7'6

Floor	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	sog, cs,					
Fin	cpt,wd,ct,vy,con					
Subfl	na,wd,comp,conc	wd				
Struc	wdfr, conc, stlfr	wd fr 2x6				
Ins	rig,batt + thk	batt 4"				
Ceiling	pl,non,conc,sts	non				
Condition	g,f,p	g				
ECO	ins,vb					
Maint						

Roof

Roof	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	f, h, gab, gam, m	gab				
Covering	shing, sheet	shing				
Color	l,d	d				
Deck	wd, mtl					
Pitch	run:rise (x :12)	21:12				
Condition	g,f,p	g				
ECO	st, wstrip, insmtl					
Maint						

6 4

Attic

Attic	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Struc	wdfr, conc, stlfr	wdfr				
Ins	rig,batt + thk	blown in 9"				
Ceiling	pl,non,conc,sts	pl/gwb				
Condition	g,f,p					
ECO	v, ins, sh,inf					
Maint						

10

Date Surveyed____________

Surveyor Initials: FE

Opening Types

Windows

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	dh,sh,c,h,a,j,gb	dbl hung				
Operation	f, fdh, cwdh, cnk	friction				
Material	wd, al, st, v	wd				
Glazing	1, 2, 3	2				
Divides	true, appl	appl				
Size	w*h	" 3				
Frames	wd, al, v, st, hol	v				
Storms	gl, pl, al, wd, st, v	7				
Treatments	roll, sdr, odr, mbl, vbl	vinyl roll				
Infiltration	low, high					
Condition	g,f,p	g				
ECO	strm, ws, dg, trim					
Maint						

Doors

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	fl, pan, sc, hol	panelled				
Material	wd, mtl, gl, pl	mtl				
Ins	y,n	y				
Glazing Qty		1				
Glazing Size	w*h	21x35				
Glazing Pane	1, 2, 3	2				
Size	w*h	32x80				
Frames	wd, al, v, st, hol	wd				
Storm	gl, pl, al, wd, st, v	al/gl				
Infiltration	low, high					
Condition	g,f,p	f				
ECO	st, wstrip, insmtl					
Maint						

Vents

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	e, d, ga, br,scr, clg	br	dryer	eave	gable	
Material	wd, mtl	wd	galv mtl	vinyl · perf	al	
Geometry	tri,sq,ci + w*h	sq / 21x8	sq 4x4	siding - 11" wide	sq / 16x24	
Frequency	spacing o.c.	1 each end	1	55" o.c.	1 each end	
Screening		y	n	na	y	
Operation	fo, mao	fixed open	fo	fo	fo	
Fan Size	dia	–	–	–	–	
Fan spd	lo,hi	–	–	–	–	
Fan control	ts, man	–	–	–	–	
Condition	g,f,p	f	f	g	g	
ECO						
Maint						

5 4

Date Surveyed____________

Surveyor Initials: FE

Heating Ventilation and Cooling

Heating Unit

		Zone 1	Zone 2	Zone 3	
Type	fa,hyd,rad	forced air			
Fuel	g,o,e,w,c	g			
Mfr		Trane			
Model No		XL90			
Age		11/88			
Control	on/off,t var	o/o tstat			
Condition	g,f,p	g			
ECO					
Maint					
Notes		2			

Cooling Unit

Type	fa,hyd,tw,non	forced air				
Fuel	g,e					
Mfr		Trane				
Model No						
Age		11/88				
Control	on/off,t var	o/o tstat				
Condition	g,f,p	g				
ECO						
Maint						
Notes						

Distribution System

Type	fa,hyd	forced air				
Insulation	fg + thk	foam board				
Material		fb				
Leakage		none apparent				
Fixture	reg,rad,fc,op	reg				
Condition	g,f,p	g				
ECO						
Maint						
Notes						

Humidification

Distribution	local,ducts	ducts @ AHU				
Control	on/of,h var	o/o hvar				
Condition	g,f,p	g				
ECO						
Maint						
Notes						

Hot Water Heater

Fuel	g	Age	w/in 4 yrs	Condition	g	
Mfr	A.O. Smith	Ins jacket	No	ECO		
Model	PGH 40 982	Pipe Ins	Y	Maint		
				Notes	1	

Date Surveyed______________

Surveyor Initials: FE

Notes

1. Furnace / Air H U & wtr Heater in excavated crawl space. Strongly recommend wh get ins jacket as crawl space is not conditioned & is ventillated

2. Furnace Model TOC 120 A960A0

3. 3 sizes. Designation is

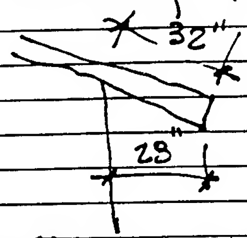
	w		h
A	28	*	45
B	36	*	45
C	32	*	36

W 1 A
- A — Size +
- 1 — Type 1
- W — indicates window

4. Siding & Soffits appear new (less than 5 yrs) including all trims

5. One end appears to be blocked

6. 32" overhang (soffit is 30")



7. Fixed operation screens in place. Do fixed operation storms go in during winter? ((No.))

8. Flue damper broken. Fireplace has airtight glass door enclosure ((Doors installed when Fireplaces rebuilt. many work))

9. All light fixtures are incandescent except as noted by this symbol: $\boxed{\circ}_f$

10. Access hatch does not have insulation

11. ((Not all units have cathedral ceilings))

12.

Date Surveyed____________

Surveyor Initials: FE

INTERVIEW

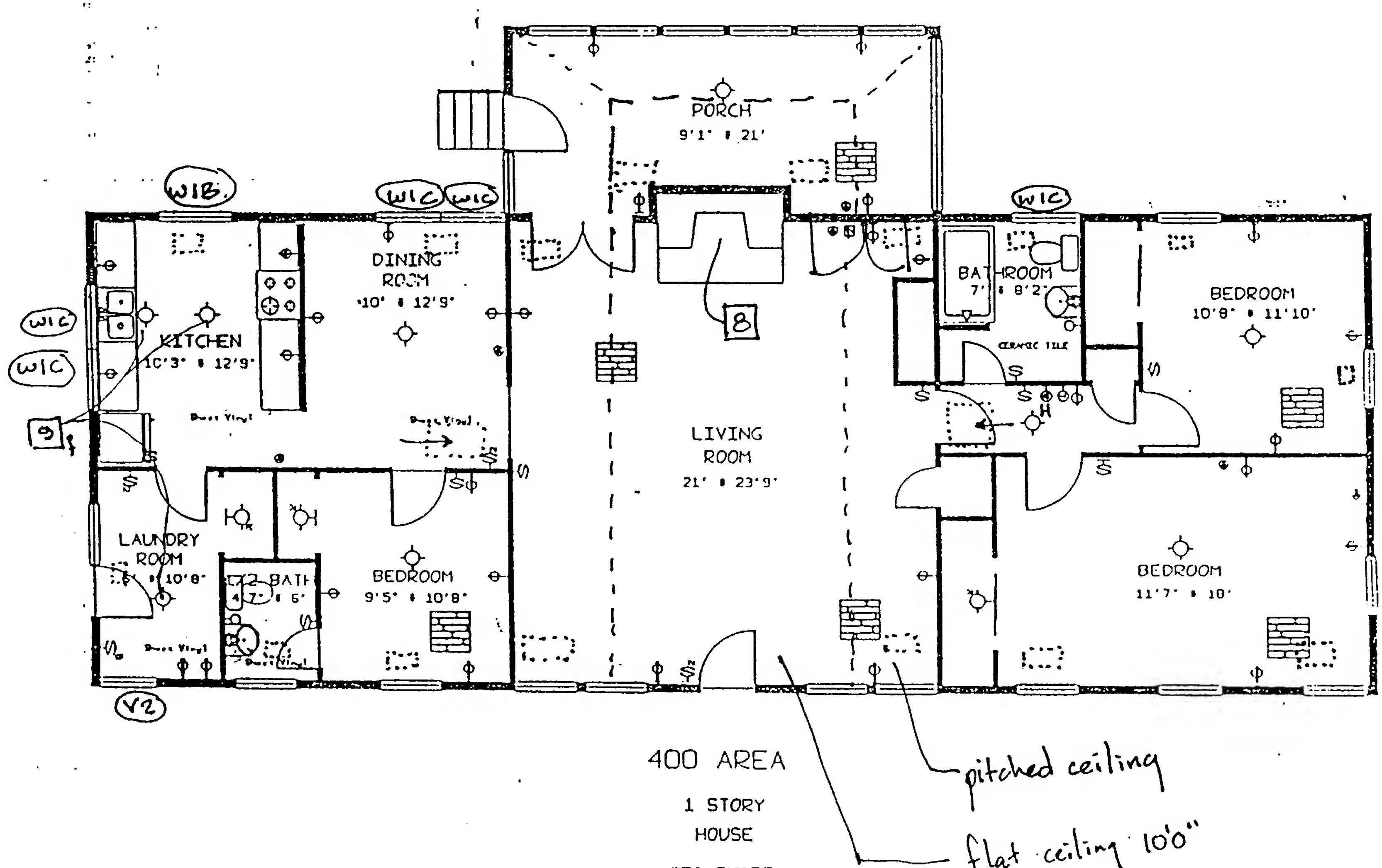
400 · T style

Not all have cathedral ceilings
cfs or wh fans - joist spacing
installed 86 leak'g windows - warp frames, infiltration in sum & wint, no storm windows
storms-doors · do not seal, HCA don't have
blankets on wh - none - HCA water real cold-a
preventive maint, wh sed, furnace cleaning, filters
siding - includes insulation
rebuilt fireplace in T's. rebuilt oil chims in L's
Glass doors not uniformly installed · @ T·470, chaplain cannot get replacem previous tenant took.
humidifiers do not work - told you cannot fix them. construction debr.
most units in shade
asthmatics - catch 22 open windows. when humidifier is down so is furnace
Uneven heating & cooling
Crawl space insulation not uniform.
Sun porch temps vary significantly from remainder of house.
walls not cold.

interview w/ residents @ T·466 & T-469
conducted 4 Nov

NEIGHBORHOOD CRUISE

T·436: has entry vestibule built into front stoop
T-441 & 442: Attics have windows & attics are not occupied



400 AREA

1 STORY

HOUSE

"T" SHAPE

SCALE: 1" = 8'

400 AREA -- 1 STORY 4 BEDROOM HOUSE
"L" SHAPE
14 UNITS

FLOORING	UNIT	QUANTITY
WOOD STRIP	SF	1330
SHEET VINYL	SF	415

ELECTRICAL		
CEILING FIXTURE	EA	10
WALL FIXTURE	EA	1
WALL FIXTURE WITH SINGLE OUTLET	EA	1
SINGLE RECEPTACLE OUTLET	EA	3
DUPLEX RECEPTACLE OUTLET	EA	26
TRIPLEX RECEPTACLE OUTLET	EA	1
SWITCH & DUPLEX RECEPTACLE	EA	1
SINGLE POLE SWITCH	EA	14
DOUBLE POLE SWITCH	EA	2
TRIPLE POLE SWITCH	EA	1
CIRCUIT BREAKER	EA	1
TELEPHONE OUTLET	EA	3
TELEVISION OUTLET	EA	1
THERMOSTAT	EA	1
HUMIDIFIER	EA	1

Energy Conservation Opportunity Survey

Field Survey Form

Location Information

Subdivision T·400 (L)

Unit No.

Geometry

	B	1	2	3
No of Floors		_1_		
Dist F to F				
Dist F to C		8'4		

Symbol Legend

- ◇ Wall Type
- ⬭ Opening Type
- ☐ Note

Envelope Types

Exterior Walls

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Prob Constr	bv,wf,cav,conc,sm	wd fr				
Ext Matl	wd,v,a,br,conc,	v siding				
Ins	rig,batt + thk	rigid 1½"				
Int Fin	pl,conc,mas	pl/gwb				
Condition	g,f,p	g				
ECO	ins,vb,shade,bar					
Maint						

Floor

≈30"

Type	sog, cs,	crawl space				
Fin	cpt,wd,ct,vy,con	varies				
Subfl	na,wd,comp,conc	wd				
Struc	wdfr, conc, stlfr	wd frame				
Ins	rig,batt + thk	none				
Ceiling	pl,non,conc,sts	–				
Condition	g,f,p	f				
ECO	ins,vb					
Maint						

$\boxed{8}$

Roof

Type	f, h, gab, gam, m	gable				
Covering	shing, sheet	shing				
Color	l,d	d				
Deck	wd, mtl	wd				
Pitch	run:rise (x :12)					
Condition	g,f,p	g				
ECO	st, wstrip, insmtl					
Maint						

Attic

Struc	wdfr, conc, stlfr	wdfr 24"oc				
Ins	rig,batt + thk	5" +10" Blown				
Ceiling	pl,non,conc,sts	2 layrs GWB				
Condition	g,f,p	g				
ECO	v, ins, sh,inf					
Maint						

Date Surveyed____________

Surveyor Initials: FE

Field Survey Form

Opening Types

Windows

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	dh,sh,c,h,a,j,gb	dh				
Operation	f, fdh, cwdh, cnk	fric/spring				
Material	wd, al, st, v	wd				
Glazing	1, 2, 3	2				
Divides	true, appl	appl				
Size	w*h	3				
Frames	wd, al, v, st, hol	wd				
Storms	gl, pl, al, wd, st, v	no				
Treatments	roll, sdr, odr, mbl, vbl	varies				
Infiltration	low, high	5				
Condition	g,f,p					
ECO	strm, ws, dg, trim					
Maint						

Doors

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	fl, pan, sc, hol	pnl	pnl	french		
Material	wd, mtl, gl, pl	gl/mtl	gl/mtl	mtl		
Ins	y,n	y	y	y		
Glazing Qty		1	1	1		
Glazing Size	w*h	24 x 3⁰	1⁸ x 3⁰	1⁸ x 5⁴		
Glazing Pane	1, 2, 3	2	2	2		
Size	w*h	36 x 6⁸	32 x 6⁸	30 x 6⁸		
Frames	wd, al, v, st, hol	wd	wd	wd		
Storm	gl, pl, al, wd, st, v	gl/mtl	gl/mtl	gl/mtl		
Infiltration	low, high	3	3	3		
Condition	g,f,p	f	f	f		
ECO	st, wstrip, insmtl					
Maint						

Vents

	Options	Type 1	Type 2	Type 3	Type 4	Type 5
Type	e, d, ga, br,scr, clg	intake air	stove hood			
Material	wd, mtl	mtl	mtl			
Geometry	tri,sq,ci + w*h	sq, 12x12	sq 12x4			
Frequency	spacing o.c.	2	1			
Screening		y	no			
Operation	fo, mao	fixed open	mech assist			
Fan Size	dia	—	residential hood			
Fan spd	lo,hi	—				
Fan control	ts, man	—				
Condition	g,f,p	g	g			
ECO						
Maint						

Date Surveyed________

Surveyor Initials: FE

Heating Ventilation and Cooling

Heating Unit

		Zone 1	Zone 2	Zone 3	
Type	fa,hyd,rad	forced air			
Fuel	g,o,e,w,c	gas			
Mfr		trane - XL90			
Model No		TUC120A960A0			
Age		5 yrs			
Control	on/off,t var	on/off tstat			
Condition	g,f,p	g			
ECO					
Maint					
Notes		6			

Cooling Unit

Type	fa,hyd,tw,non	fa				
Fuel	g,e					
Mfr		See Heating				
Model No						
Age						
Control	on/off,t var					
Condition	g,f,p					
ECO						
Maint						
Notes						

Distribution System

Type	fa,hyd	forced air				
Insulation	fg + thk	foam board				
Material		foamboard				
Leakage		no				
Fixture	reg,rad,fc,op	reg				
Condition	g,f,p	g				
ECO						
Maint						
Notes						

Humidification

NU-MIST, Bloomington, Ill.

Distribution	local,ducts	ducts				
Control	on/of,h var	on/of				
Condition	g,f,p					
ECO						
Maint						
Notes						

Hot Water Heater

Fuel	g	Age	5 yrs ±	Condition	g	
Mfr	Vanguard	Ins jacket	No	ECO		
Model	6E705	Pipe Ins	No	Maint		
	40 gallon			Notes	6	

Date Surveyed______________

Surveyor Initials: FE

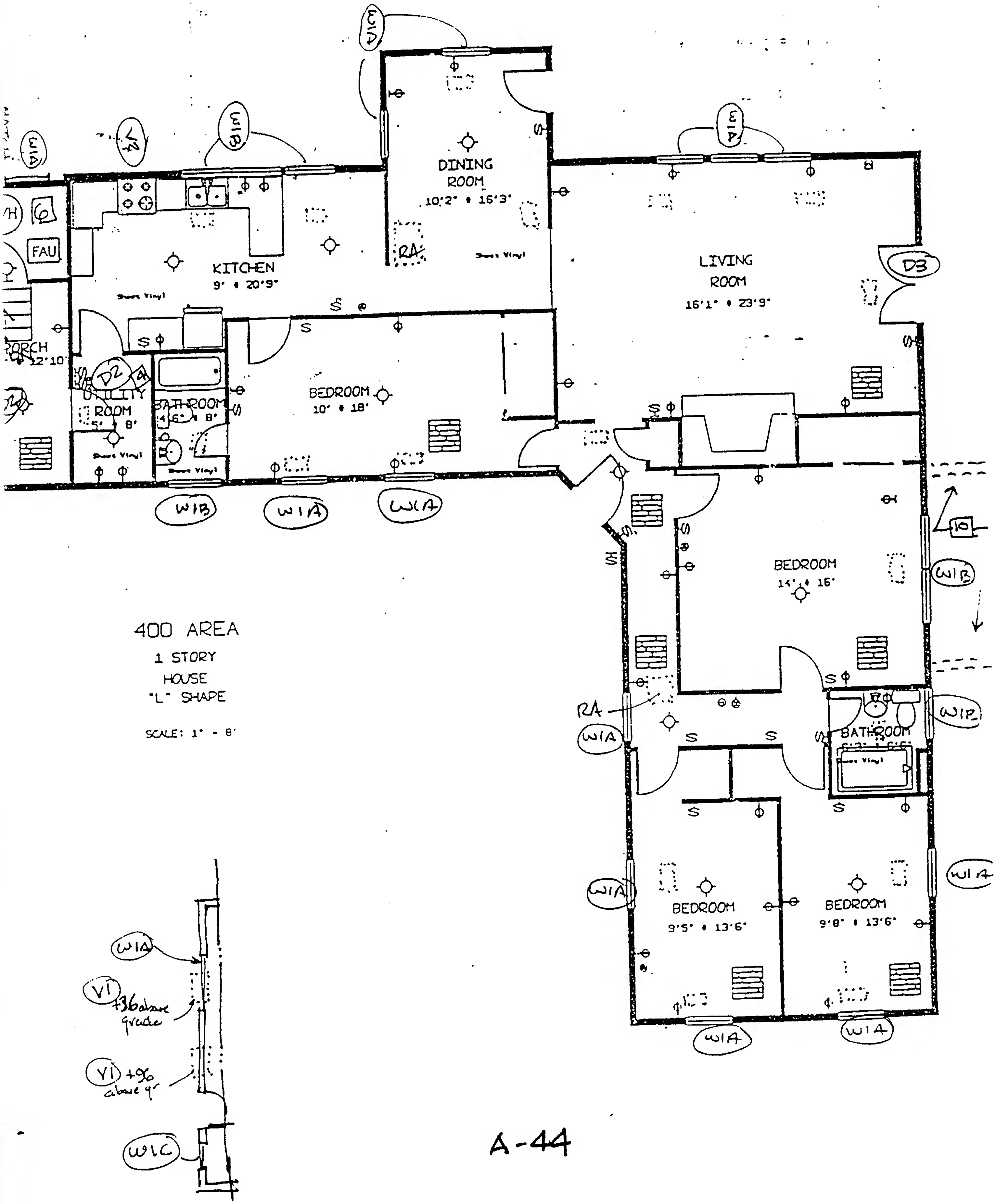
Field Survey Form

Notes

1. ~~6~~ regular occupants. HW runs out quick - 40 gal on opp end!
2. ~~Fireplace~~ Chimney has no flue. Glass doors do not fit well.
3. Storm doors do not seal @ all. Passage doors seal well w/ plastic coated foam weather strip.
4. No storm. Porch is enclosed, not insulated
5. When locked, windows do not leak. Frames leak low
6. Utility room not insulated. 1 fixed open vent (V1). Stairs leading to porch are open wood. No stop for air travel from Utility to porch.
7. Evidence of termite damage localized as indicated. Also, steel floor jack has ~~...~~ fallen over. Potential collapse ~~...~~ point. Have advised Capital Projects.
8. Crawl space is not ventilated.
9. Window dims
   A 28 x 48
   B 32 x 39
   C 23 x 39
10. Bedroom addition in some units.

Date Surveyed____________

Surveyor Initials: FE



400 AREA
1 STORY
HOUSE
"L" SHAPE

SCALE: 1" = 8'

A-44

400L INTERVIEW

A G E N D A

1. Infil
2. Air Bal
3. Hot water

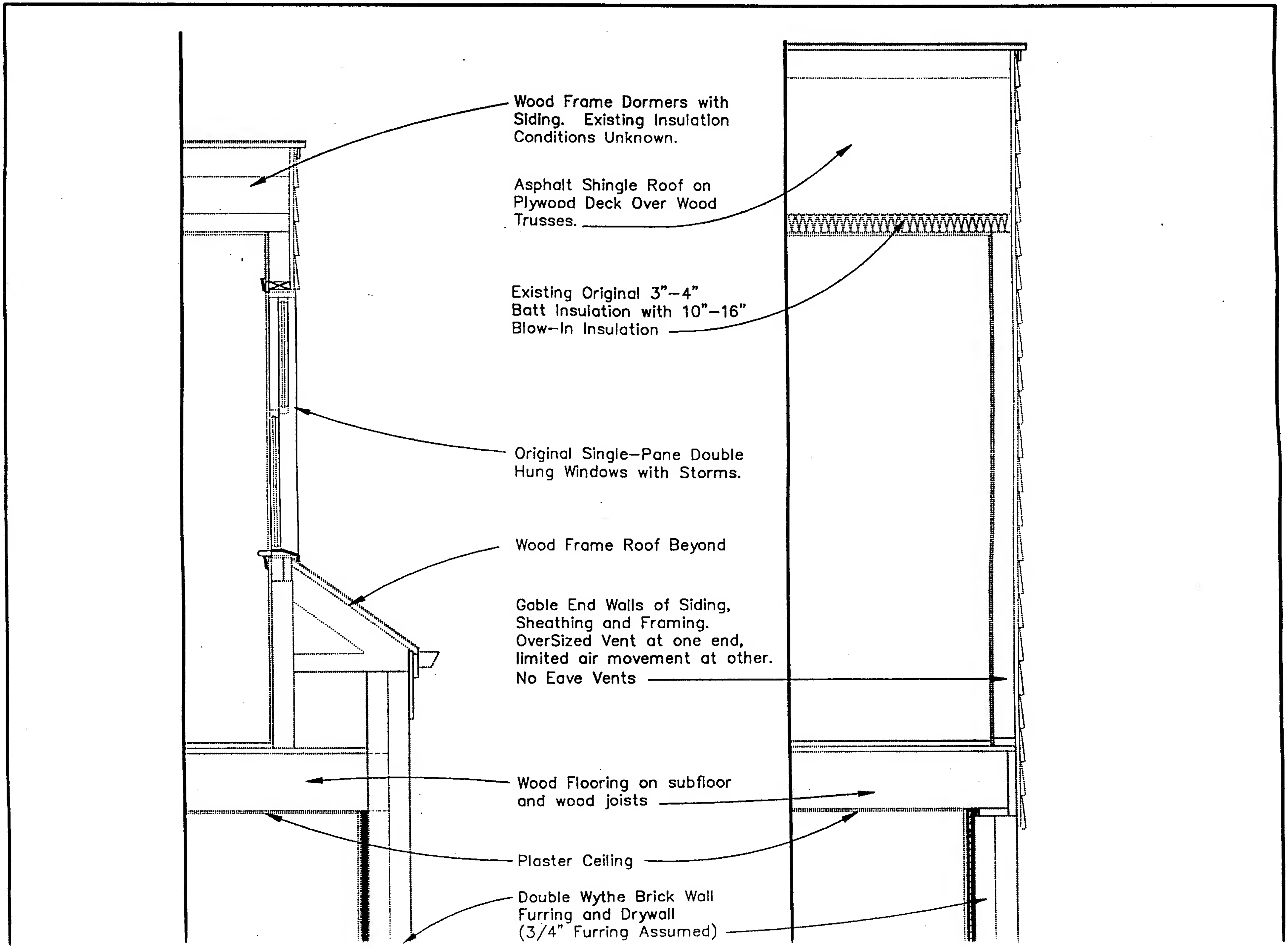
R E S U L T S

1. Not noticeable
2. Good.
3. On cold days 1 person can drain tank.
4. Flooring - thickness. No Cold floors. Room addition floor is insulated.

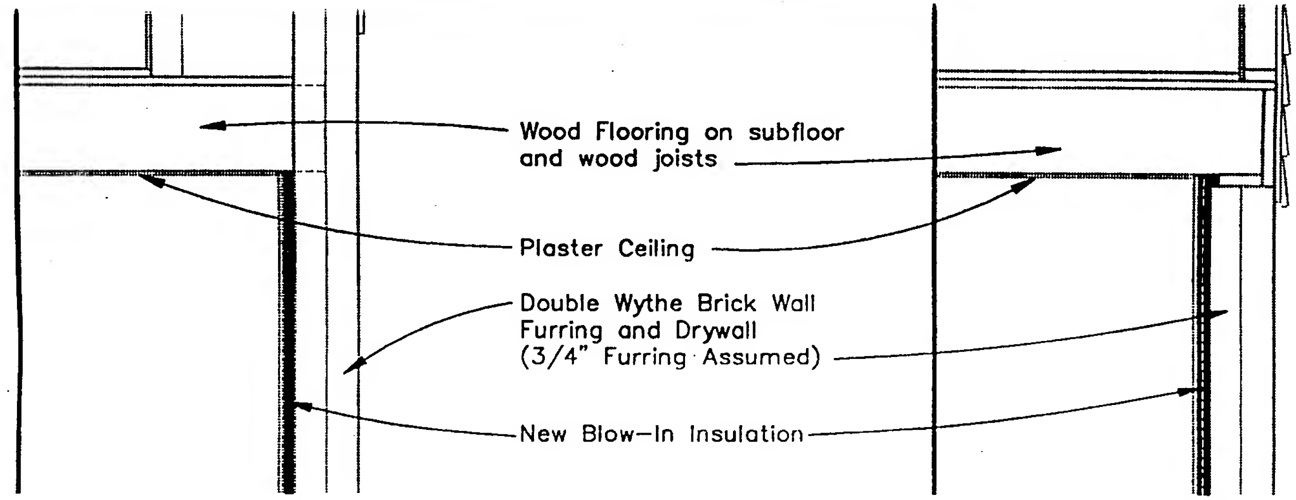
Appendix B

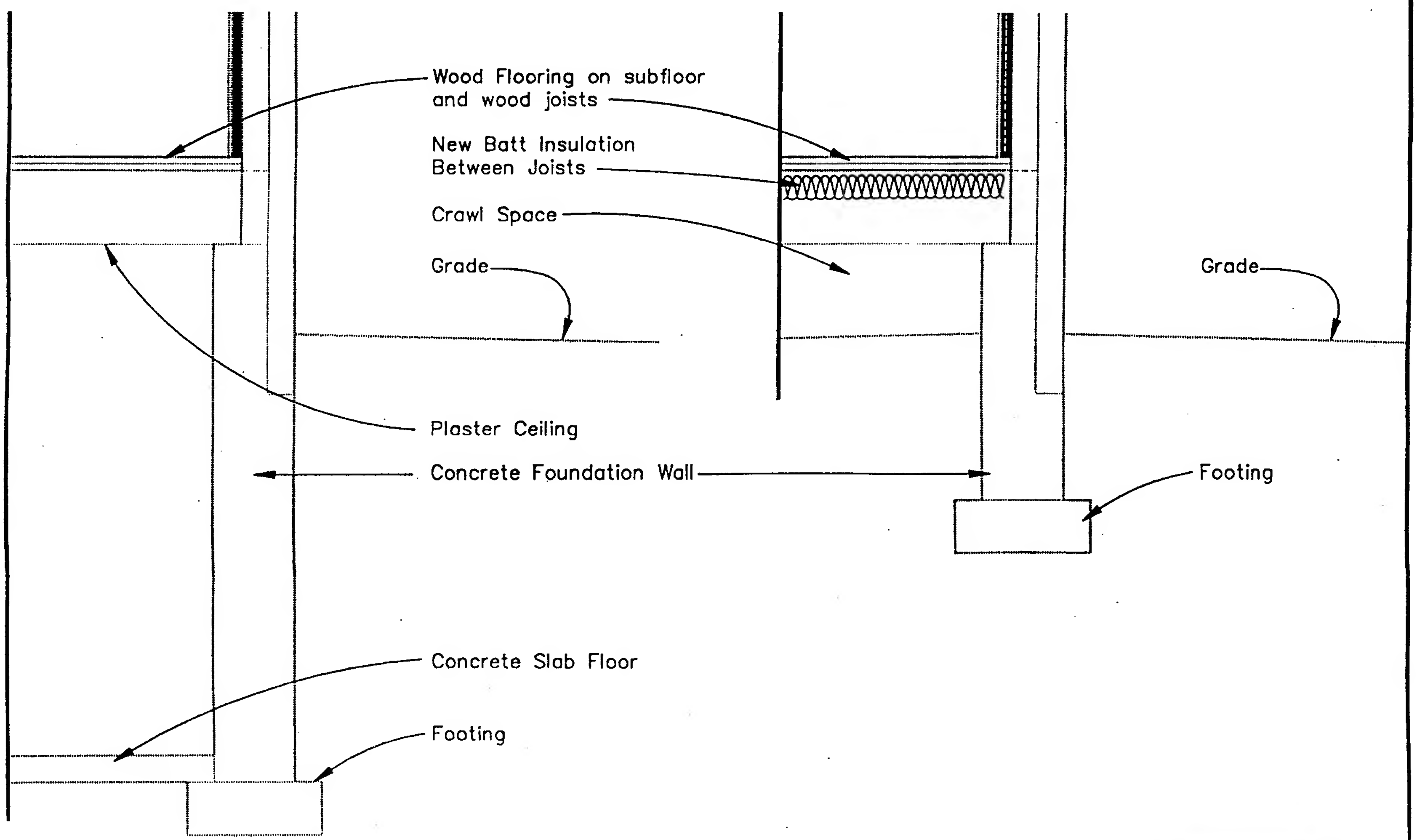
Building Wall Sections

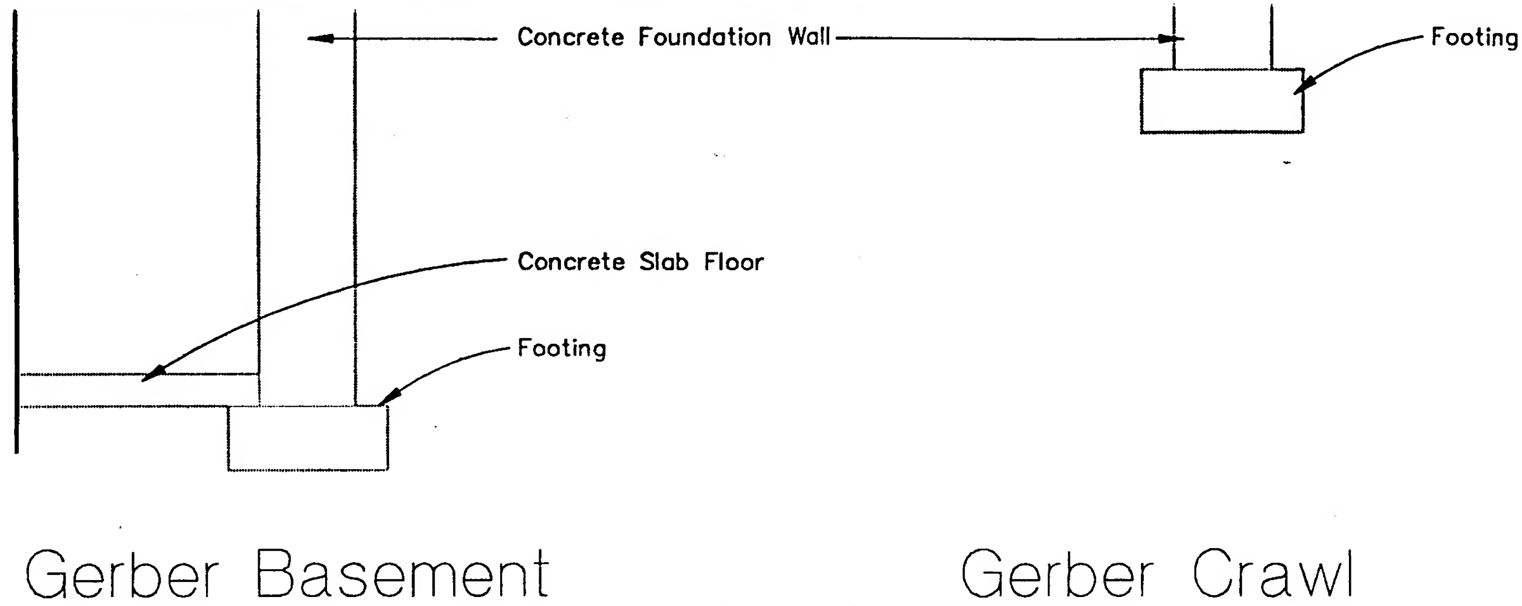
(1)



Wood Frame Dormers with Siding. Existing Insulation Conditions Unknown.
Asphalt Shingle Roof on Plywood Deck Over Wood Trusses.
Existing Original 3"–4" Batt Insulation with 10"–16" Blow–In Insulation
Original Single–Pane Double Hung Windows with Storms.
Wood Frame Roof Beyond
Gable End Walls of Siding, Sheathing and Framing. OverSized Vent at one end, limited air movement at other.
No Eave Vents
Wood Flooring on subfloor and wood joists
Plaster Ceiling
Double Wythe Brick Wall Furring and Drywall (3/4" Furring Assumed)


Wood Flooring on subfloor and wood joists
Plaster Ceiling
Double Wythe Brick Wall Furring and Drywall (3/4" Furring Assumed)
New Blow-In Insulation


Wood Flooring on subfloor and wood joists
New Batt Insulation Between Joists
Crawl Space
Grade
Grade
Plaster Ceiling
Concrete Foundation Wall
Footing
Concrete Slab Floor
Footing



Project:	Fort Belvoir Family Housing ECO Study COE Project No. DACA 31-92-D-0061 Delivery Order No. 0005	Project No.:	60592.00
		Designed by:	FE
		Drawn by:	FE
		Checked by:	JS
Title:	Wall Section - Gerber Village (100 Area)	Sheet No.:	1 of: 4
Date:	6/30/94 Scale: 1/2"=1'-0"	Drawing No.:	

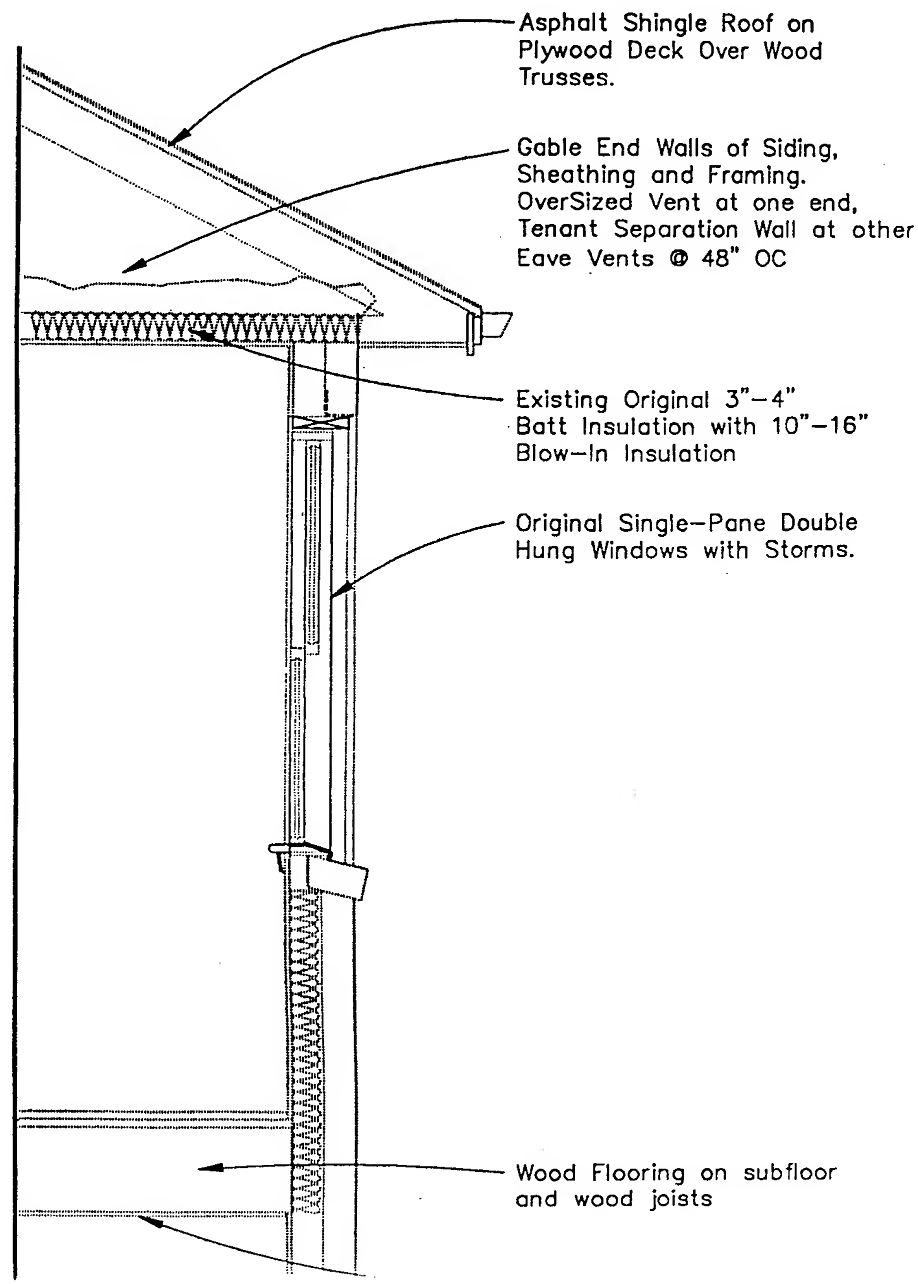
Einhorn
Yaffee
Prescott

ARCHITECTURE & ENGINEERING, P.C.
THE ARGUS BUILDING
BROADWAY AT BEAVER
POST OFFICE BOX 617
ALBANY, NY 12201-0617
TEL (518) 463-2141

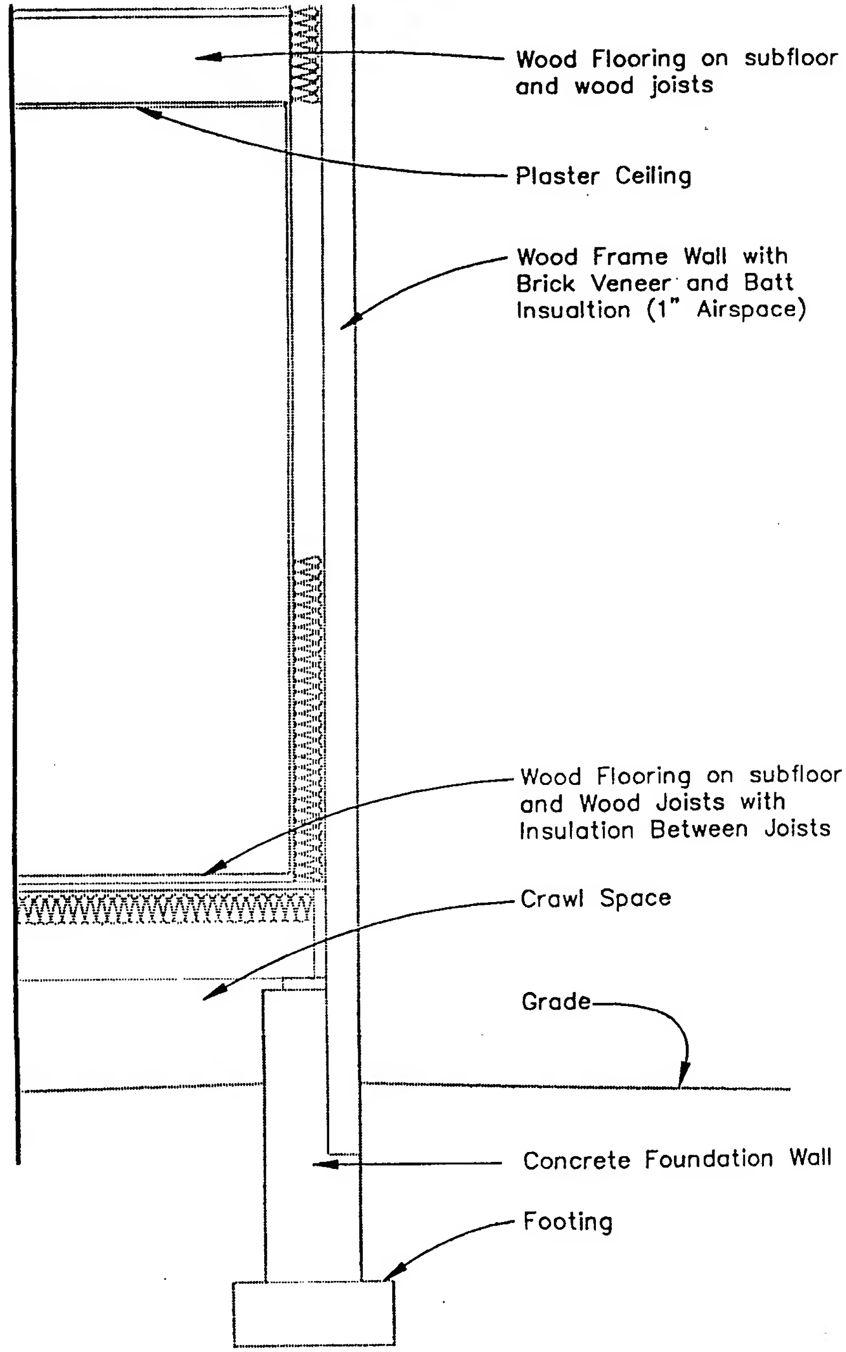
THE FLOUR MILL
1000 POTOMAC ST., NW
WASHINGTON, DC 20007
TEL (202) 471-5000

3

1



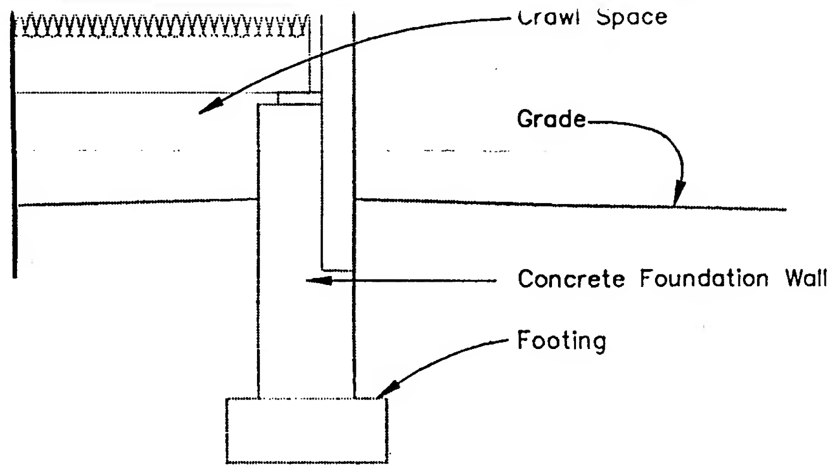
Asphalt Shingle Roof on Plywood Deck Over Wood Trusses.
Gable End Walls of Siding, Sheathing and Framing. OverSized Vent at one end, Tenant Separation Wall at other Eave Vents @ 48" OC
Existing Original 3"–4" Batt Insulation with 10"–16" Blow–In Insulation
Original Single–Pane Double Hung Windows with Storms.
Wood Flooring on subfloor and wood joists



River Village

Project: Fort Belvoir Family Housing ECO Study | Project No.: 60592.00

②



River Village

(3)

Project:	Fort Belvoir Family Housing ECO Study COE Project No. DACA 31-92-D-0061 Delivery Order No. 0005
Title:	Wall Section - River Village (1600 Area)
Date:	6/30/94
Scale:	1/2"=1'-0"

Project No.:	60592.00
Designed by:	FE
Drawn by:	FE
Checked by:	JS
Sheet No.:	2 of: 4
Drawing No.:	

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WASHINGTON, DC 20007
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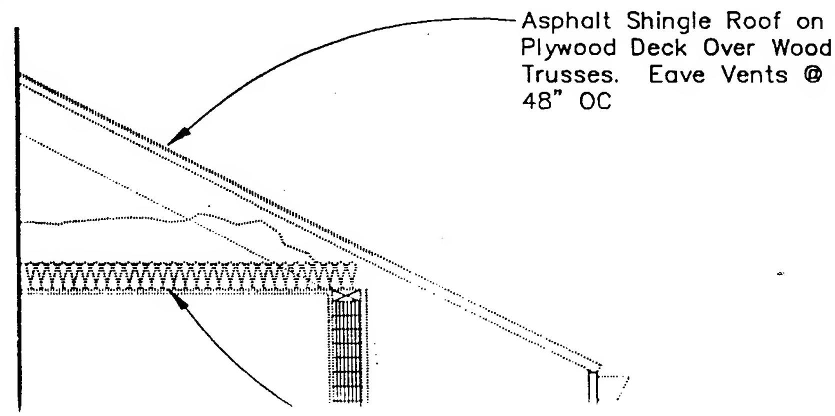
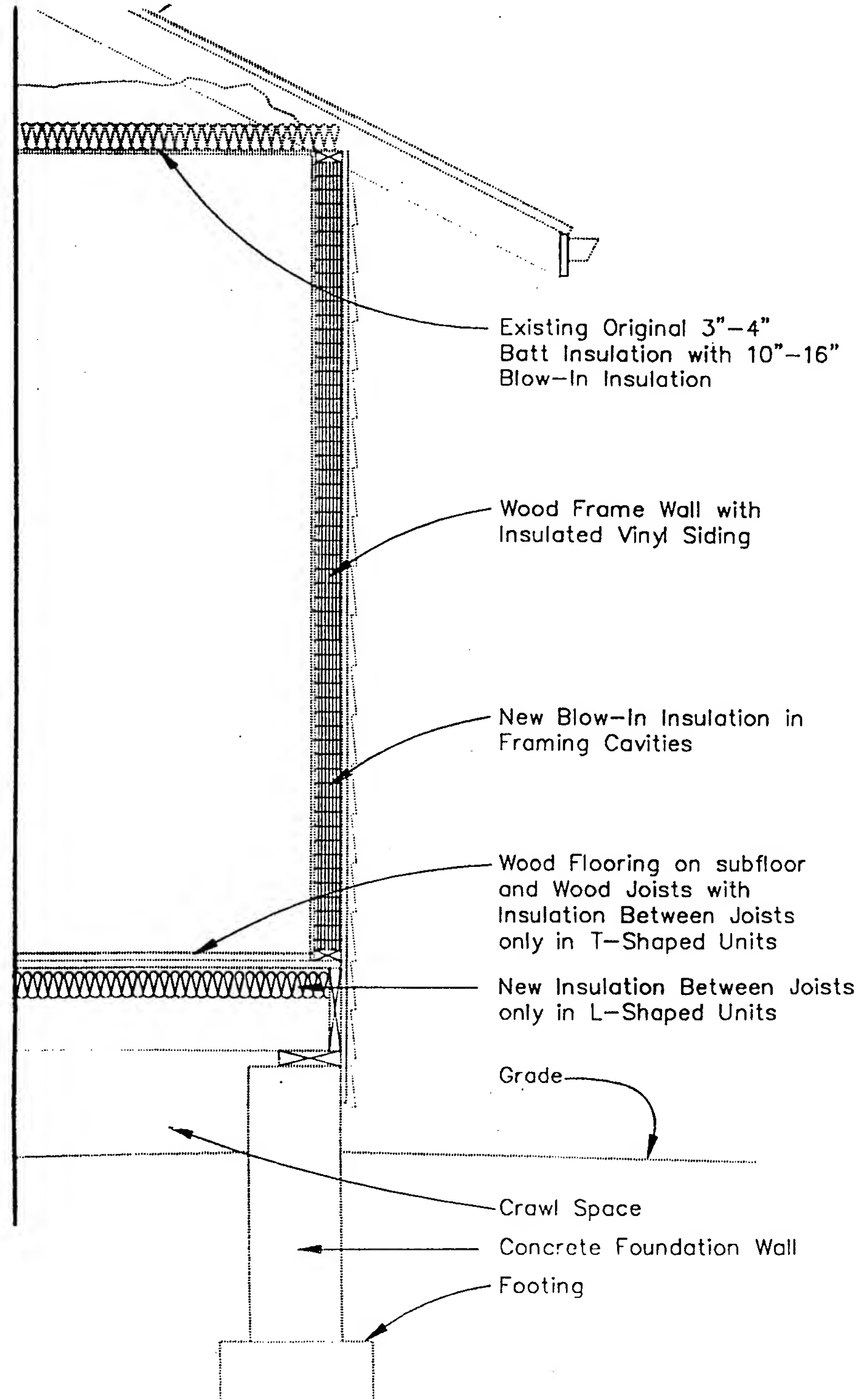
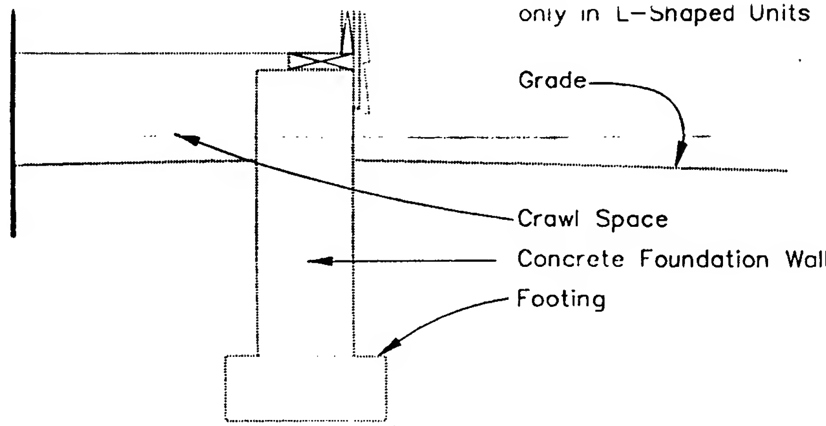
Einhorn Yaffee Prescott

1


Asphalt Shingle Roof on
Plywood Deck Over Wood
Trusses. Eave Vents @
48" OC



Existing Original 3"–4"
Batt Insulation with 10"–16"
Blow–In Insulation
Wood Frame Wall with
Insulated Vinyl Siding
New Blow–In Insulation in
Framing Cavities
Wood Flooring on subfloor
and Wood Joists with
Insulation Between Joists
only in T–Shaped Units
New Insulation Between Joists
only in L–Shaped Units
Grade
Crawl Space
Concrete Foundation Wall
Footing

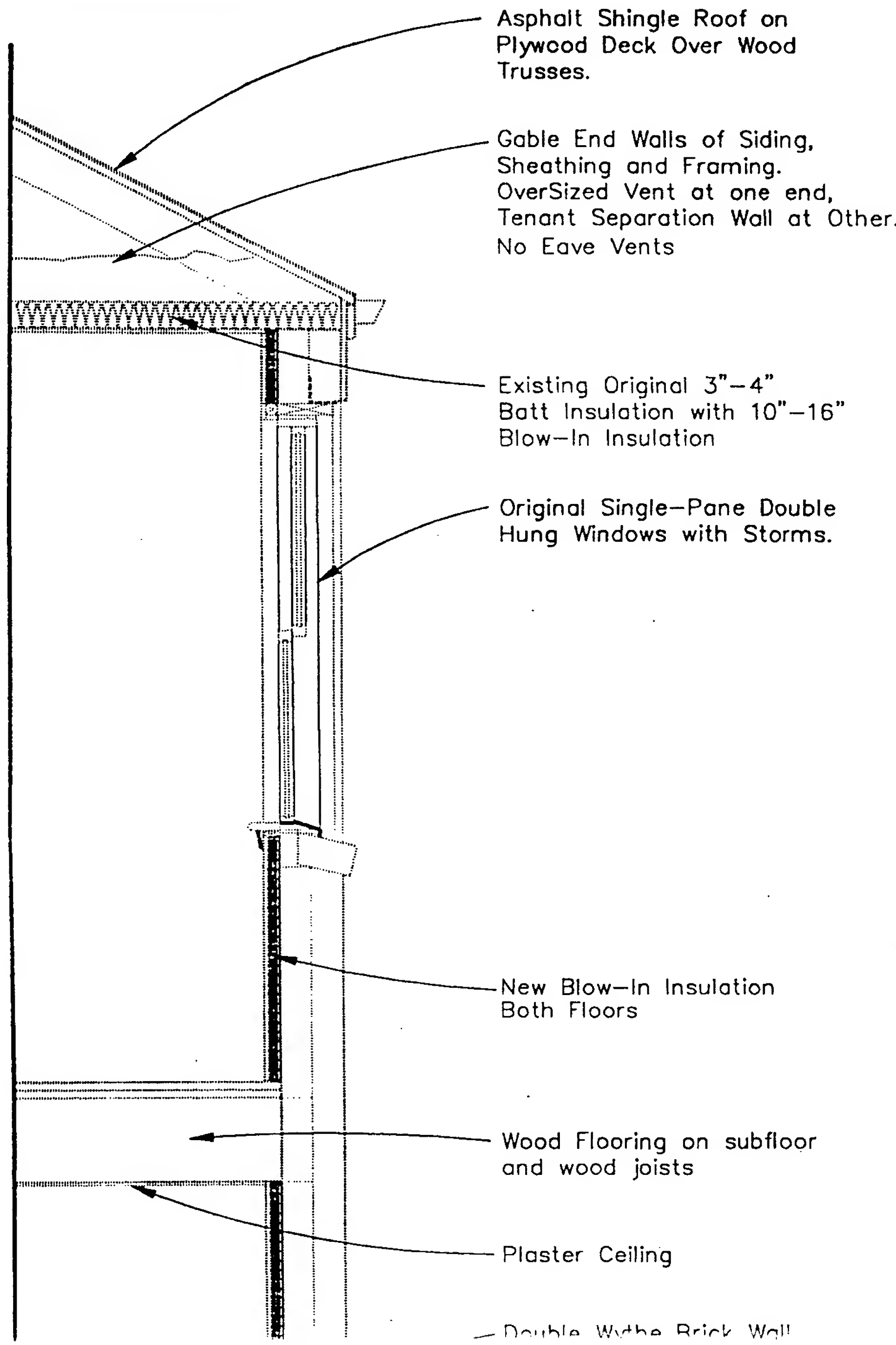


T-400s

Project:	Fort Belvoir Family Housing ECO Study COE Project No. DACA 31-92-D-0061 Delivery Order No. 0005	Project No.: 60592.00 Designed by: FE Drawn by: FE Checked by: JS Sheet No.: 3 of: 4	Einhorn Yaffee Prescott ARCHITECTURE & ENGINEERING, P.C. THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 TEL (518) 463-2141 THE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL (202) 471-5000
Title:	Wall Section - T-400 Area		
Date:	6/30/94 Scale: 1/2"=1'-0"	Drawing No.:	

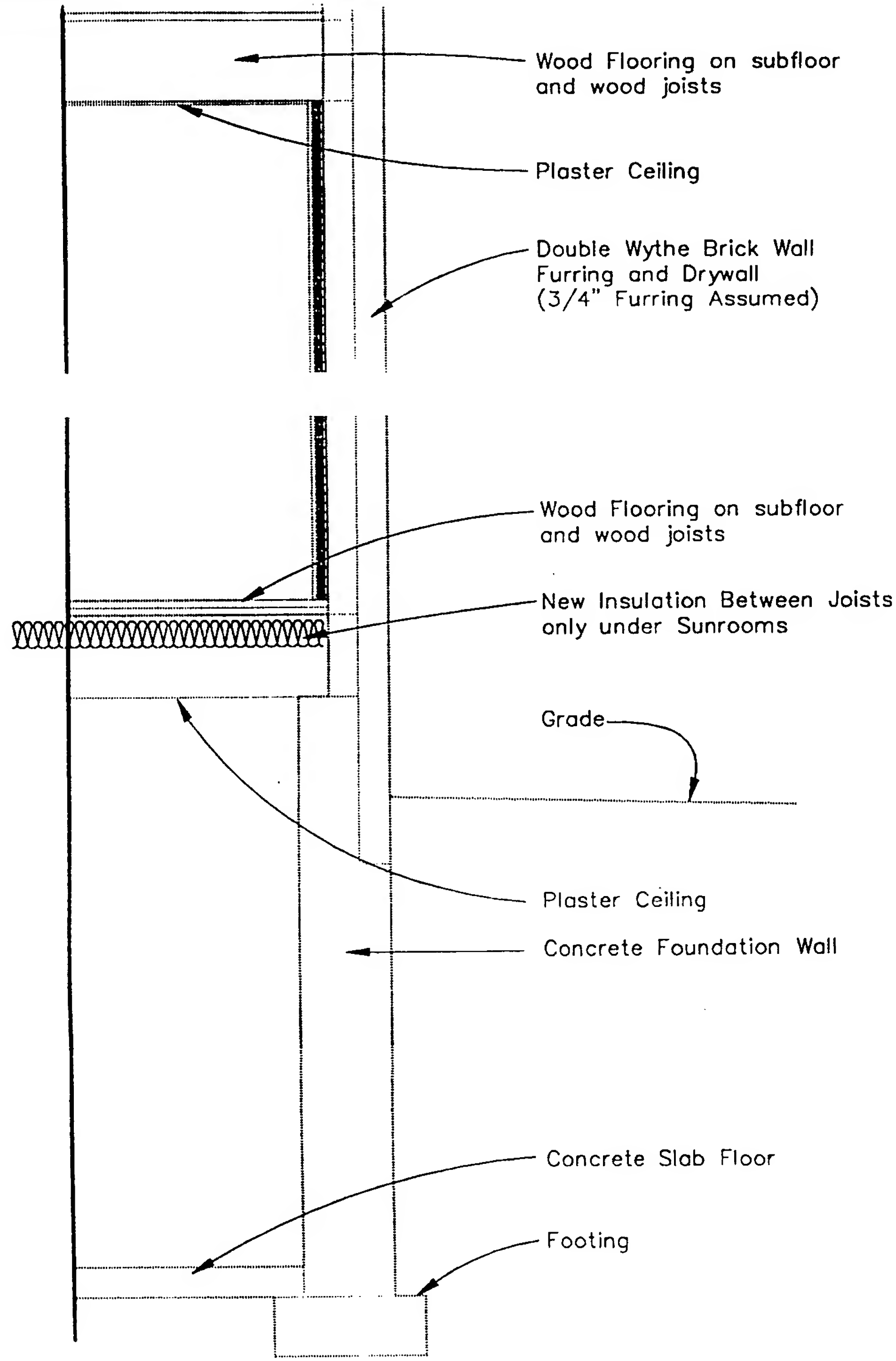
(3)

B-3



Asphalt Shingle Roof on Plywood Deck Over Wood Trusses.
Gable End Walls of Siding, Sheathing and Framing. OverSized Vent at one end, Tenant Separation Wall at Other. No Eave Vents
Existing Original 3"–4" Batt Insulation with 10"–16" Blow–In Insulation
Original Single–Pane Double Hung Windows with Storms.
New Blow–In Insulation Both Floors
Wood Flooring on subfloor and wood joists
Plaster Ceiling

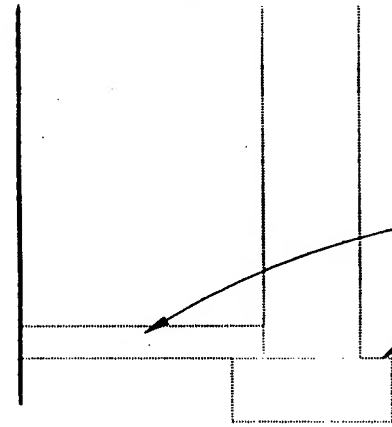
1



Wood Flooring on subfloor and wood joists
Plaster Ceiling
Double Wythe Brick Wall Furring and Drywall (3/4" Furring Assumed)
Wood Flooring on subfloor and wood joists
New Insulation Between Joists only under Sunrooms
Grade
Plaster Ceiling
Concrete Foundation Wall
Concrete Slab Floor
Footing

166-171

2



166-171

Project:	Fort Belvoir Family Housing ECO Study COE Project No. DACA 31-92-D-0061 Delivery Order No. 0005	Project No.: 60592.00 Designed by: FE Drawn by: FE Checked by: JS Sheet No.: 4 of: 4	ARCHITECTURE & ENGINEERING, P.C. THE ARGUS BUILDING BROADWAY AT BEAVER POST OFFICE BOX 617 ALBANY, NY 12201-0617 TEL (518) 463-2141 THE FLOUR MILL 1000 POTOMAC ST., NW WASHINGTON, DC 20007 TEL (202) 471-5000
Title:	Wall Section - 166-171 Area		Einhorn Yaffee Prescott
Date:	6/30/94 Scale: 1/2"=1'-0"	Drawing No.:	

(3)

Appendix C

ASEAM Input Data

- Weather Data (DOD Format)
- Loads Input Files
- Sytem Input File
- Plant Input File

ASEAM Input

Weather Data File

(DOD Format)

Weather Data Report

Weather File : FTBLVR

Weather Data Format : DOD

ASHRAE Design Summer Temperature (2 %)	90	deg
ASHRAE Design Winter Temperature (97%)	12	deg
Maximum Bin Temperature	97.0	deg
Minimum Bin Temperature	-8.0	deg
Weather Station Latitude	38.7	deg N
Solar Station Latitude	38.8	deg N
Weather Station Longitude	77.2	deg W
Solar Station Longitude	77.0	deg W
Average Barometric Pressure	29.90	in Hg

Bin Hours of Occurence

Month	Bin Temp	Mid 8 AM	8 AM 4 PM	4 PM Mid	Total Hours	Hum Ratio	MCWB deg F
Jan	72.0	0	1	0	1	0.00828	60.0
Jan	67.0	0	1	1	2	0.00881	59.0
Jan	62.0	1	3	1	5	0.00648	53.0
Jan	57.0	2	7	4	13	0.00604	50.0
Jan	52.0	3	11	7	21	0.00472	45.0
Jan	47.0	7	27	15	49	0.00405	41.0
Jan	42.0	19	39	29	87	0.00390	38.0
Jan	37.0	30	45	42	117	0.00303	33.0
Jan	32.0	45	49	50	144	0.00269	29.0
Jan	27.0	45	31	46	122	0.00200	24.0
Jan	22.0	36	18	26	80	0.00175	20.0
Jan	17.0	28	11	14	53	0.00128	15.0
Jan	12.0	17	4	7	28	0.00118	11.0
Jan	7.0	9	1	4	14	0.00113	7.0
Jan	2.0	4	0	1	5	0.00087	2.0
Jan	-3.0	2	0	0	2	0.00067	-3.0
Jan	-8.0	1	0	0	1	0.00074	-7.0
Feb	72.0	0	1	0	1	0.00706	58.0
Feb	67.0	0	2	1	3	0.00761	57.0
Feb	62.0	0	3	3	6	0.00648	53.0
Feb	57.0	2	10	6	18	0.00553	49.0
Feb	52.0	5	15	9	29	0.00472	45.0
Feb	47.0	8	26	14	48	0.00405	41.0
Feb	42.0	16	42	38	96	0.00349	37.0
Feb	37.0	35	44	44	123	0.00303	33.0
Feb	32.0	44	39	47	130	0.00269	29.0
Feb	27.0	47	25	35	107	0.00200	24.0
Feb	22.0	29	10	16	55	0.00175	20.0
Feb	17.0	17	4	7	28	0.00128	15.0
Feb	12.0	12	2	3	17	0.00118	11.0
Feb	7.0	6	0	0	6	0.00087	6.0
Feb	2.0	2	0	0	2	0.00087	2.0
Mar	82.0	0	2	0	2	0.00727	62.0
Mar	77.0	0	4	2	6	0.00653	59.0

Mar	72.0	0	8	4	12	0.00647	57.0
Mar	67.0	1	11	6	18	0.00645	55.0
Mar	62.0	3	13	10	26	0.00595	52.0
Mar	57.0	7	21	18	46	0.00503	48.0
Mar	52.0	8	32	24	64	0.00426	44.0
Mar	47.0	21	45	38	104	0.00405	41.0
Mar	42.0	39	50	48	137	0.00349	37.0
Mar	37.0	53	36	44	133	0.00303	33.0
Mar	32.0	56	18	34	108	0.00269	29.0
Mar	27.0	32	7	15	54	0.00233	25.0
Mar	22.0	19	2	5	26	0.00175	20.0
Mar	17.0	5	0	1	6	0.00157	16.0
Mar	12.0	2	0	0	2	0.00118	11.0
Mar	7.0	1	0	0	1	0.00113	7.0
Apr	92.0	0	1	0	1	0.00989	69.0
Apr	87.0	0	5	1	6	0.01029	68.0
Apr	82.0	0	11	5	16	0.00929	65.0
Apr	77.0	0	14	7	21	0.00842	62.0
Apr	72.0	2	20	13	35	0.00828	60.0
Apr	67.0	8	30	22	60	0.00820	58.0
Apr	62.0	17	37	31	85	0.00817	56.0
Apr	57.0	27	40	36	103	0.00762	53.0
Apr	52.0	34	39	43	116	0.00666	49.0
Apr	47.0	44	28	40	112	0.00633	46.0
Apr	42.0	49	13	29	91	0.00562	42.0
Apr	37.0	33	2	9	44	0.00545	39.0
Apr	32.0	19	0	4	23	0.00454	34.0
Apr	27.0	6	0	1	7	0.00404	30.0
Apr	22.0	1	0	0	1	0.00365	26.0
May	92.0	0	4	1	5	0.00989	69.0
May	87.0	0	13	4	17	0.01104	69.0
May	82.0	0	25	11	36	0.01071	67.0
May	77.0	2	37	20	59	0.00975	64.0
May	72.0	10	51	35	96	0.00956	62.0
May	67.0	30	44	47	121	0.00943	60.0
May	62.0	49	37	46	132	0.00817	56.0
May	57.0	55	22	39	116	0.00762	53.0
May	52.0	45	12	26	83	0.00666	49.0
May	47.0	32	3	12	47	0.00585	45.0
May	42.0	17	1	6	24	0.00474	40.0
May	37.0	7	0	1	8	0.00421	36.0
May	32.0	2	0	0	2	0.00340	31.0
Jun	97.0	0	2	1	3	0.01538	77.0
Jun	92.0	0	14	2	16	0.01477	75.0
Jun	87.0	0	40	14	54	0.01422	73.0
Jun	82.0	2	56	30	88	0.01376	71.0
Jun	77.0	12	60	46	118	0.01186	67.0
Jun	72.0	49	38	57	144	0.01230	66.0
Jun	67.0	68	20	46	134	0.01138	63.0
Jun	62.0	48	8	25	81	0.00996	59.0
Jun	57.0	36	2	15	53	0.00874	55.0
Jun	52.0	18	0	4	22	0.00770	51.0
Jun	47.0	5	0	1	6	0.00633	46.0
Jun	42.0	2	0	0	2	0.00562	42.0
Jul	97.0	0	2	0	2	0.01538	77.0
Jul	92.0	0	23	4	27	0.01477	75.0

Jul	87.0	0	63	21	84	0.01507	74.0
Jul	82.0	5	75	44	124	0.01376	71.0
Jul	77.0	35	54	64	153	0.01413	70.0
Jul	72.0	87	24	70	181	0.01452	69.0
Jul	67.0	72	5	32	109	0.01206	64.0
Jul	62.0	32	1	10	43	0.01058	60.0
Jul	57.0	14	0	2	16	0.00874	55.0
Jul	52.0	3	0	0	3	0.00770	51.0
Aug	97.0	0	2	0	2	0.01631	78.0
Aug	92.0	0	20	4	24	0.01565	76.0
Aug	87.0	0	55	18	73	0.01507	74.0
Aug	82.0	2	74	38	114	0.01456	72.0
Aug	77.0	29	61	61	151	0.01413	70.0
Aug	72.0	82	30	71	183	0.01376	68.0
Aug	67.0	73	6	34	113	0.01206	64.0
Aug	62.0	35	1	15	51	0.01058	60.0
Aug	57.0	21	0	6	27	0.00874	55.0
Aug	52.0	6	0	1	7	0.00770	51.0
Aug	47.0	1	0	0	1	0.00633	46.0
Aug							
Sep	92.0	0	7	1	8	0.01477	75.0
Sep	87.0	0	31	6	37	0.01422	73.0
Sep	82.0	0	41	15	56	0.01297	70.0
Sep	77.0	8	51	34	93	0.01260	68.0
Sep	72.0	38	46	48	132	0.01230	66.0
Sep	67.0	49	34	43	126	0.01071	62.0
Sep	62.0	42	20	40	102	0.00935	58.0
Sep	57.0	46	8	31	85	0.00817	54.0
Sep	52.0	32	2	15	49	0.00717	50.0
Sep	47.0	16	0	6	22	0.00585	45.0
Sep	42.0	7	0	1	8	0.00562	42.0
Sep	37.0	1	0	0	1	0.00421	36.0
Oct	92.0	0	1	0	1	0.00989	69.0
Oct	87.0	0	2	0	2	0.01260	71.0
Oct	82.0	0	8	1	9	0.01145	68.0
Oct	77.0	0	23	4	27	0.01114	66.0
Oct	72.0	6	39	16	61	0.01022	63.0
Oct	67.0	16	49	30	95	0.00943	60.0
Oct	62.0	25	48	39	112	0.00817	56.0
Oct	57.0	36	42	45	123	0.00708	52.0
Oct	52.0	46	25	43	114	0.00616	48.0
Oct	47.0	41	8	33	82	0.00539	44.0
Oct	42.0	32	2	22	56	0.00474	40.0
Oct	37.0	28	0	11	39	0.00381	35.0
Oct	32.0	15	0	3	18	0.00340	31.0
Oct	27.0	4	0	1	5	0.00299	27.0
Nov	77.0	0	3	1	4	0.00975	64.0
Nov	72.0	1	6	2	9	0.00892	61.0
Nov	67.0	3	17	6	26	0.00820	58.0
Nov	62.0	8	31	16	55	0.00759	55.0
Nov	57.0	17	41	23	81	0.00655	51.0
Nov	52.0	27	46	35	108	0.00519	46.0
Nov	47.0	27	41	39	107	0.00449	42.0
Nov	42.0	36	31	47	114	0.00390	38.0
Nov	37.0	43	16	38	97	0.00342	34.0
Nov	32.0	44	5	23	72	0.00304	30.0
Nov	27.0	26	1	9	36	0.00266	26.0

Nov	22.0	8	0	1	9	0.00205	21.0
Nov	17.0	1	0	0	1	0.00185	17.0
Dec	72.0	0	1	1	2	0.00828	60.0
Dec	67.0	0	4	1	5	0.00820	58.0
Dec	62.0	2	6	3	11	0.00759	55.0
Dec	57.0	5	13	7	25	0.00655	51.0
Dec	52.0	6	20	11	37	0.00519	46.0
Dec	47.0	12	26	23	61	0.00449	42.0
Dec	42.0	25	45	32	102	0.00390	38.0
Dec	37.0	34	51	44	129	0.00303	33.0
Dec	32.0	51	42	54	147	0.00269	29.0
Dec	27.0	43	23	39	105	0.00233	25.0
Dec	22.0	32	12	21	65	0.00175	20.0
Dec	17.0	23	3	8	34	0.00157	16.0
Dec	12.0	12	1	3	16	0.00118	11.0
Dec	7.0	3	0	0	3	0.00113	7.0
Dec	2.0	1	0	0	1	0.00063	1.0

Monthly Data

Solar File : WASHNTDC

Month	Max Bin	Min Bin	Wind mph	FPSS	Sunrise Hour	Sunset Hour
Jan	72.0	-8.0	11.0	0.49	7.50	17.07
Feb	72.0	2.0	11.0	0.53	7.09	17.64
Mar	82.0	7.0	12.0	0.56	6.43	18.13
Apr	92.0	22.0	8.9	0.58	5.62	18.64
May	92.0	32.0	9.4	0.58	6.01	20.12
Jun	97.0	42.0	10.5	0.64	5.78	20.48
Jul	97.0	52.0	6.8	0.63	5.98	20.47
Aug	97.0	47.0	6.8	0.63	6.43	19.99
Sep	92.0	37.0	9.2	0.62	6.90	19.20
Oct	92.0	27.0	7.4	0.60	7.38	18.40
Nov	77.0	17.0	8.3	0.52	6.93	16.82
Dec	72.0	2.0	8.0	0.47	7.39	16.69

ASEAM Load Input

- Gerber Village 100 Area
- Gerber Village 100 Area
  (with/without Basement)
- 166-171 Area
- 400 Area
  ('T' Shape and 'L'Shape)
- River Village 1600 Area

DATA ECHO FOR LOADS INPUT FILE: GVA3.LID

BUILDING/PROJECT DATA

Building File Name	: GV100A
Building Name	: GERBER VILLAGE 100A
Project Number	: 60592.00
Building Address	: FT. BELVOIR
	: VA
Building Type	: 2 STORY HOUSE/NO BASEMT.
Building gross floor area	: 1650 ft2
Building net conditioned area	: 1650 ft2
Number of zones	: 2
Building Location	
North latitude	: 39 deg
West longitude	: 77 deg
Time Zone Number	: 5
Daylight Savings Time	: Yes
Typical Weekday Operating Schedule	
Occupancy start hour	: 18
Operating hours/day	: 14
Summer Thermostat Schedule	
Beginning month	: May
Ending month	: October

Typical Occupied Schedule

Weekdays	from :	1800	to	800
Saturdays	from :	2000	to	1000
Sundays	from :	1600	to	800

ZONE DATA FOR ZONE 1 - FIRST FLOOR

Zone label	: FIRST FLOOR
Zone function	:
Zone area	: 1030 ft2
Floor to ceiling height	: 8.8 ft

Thermostat Set Point Temperatures

Summer occupied temperature	: 75 deg F
Winter occupied temperature	: 68 deg F
Winter unoccupied temperature	: 68 deg F

LIGHTING DATA FOR ZONE 1 - FIRST FLOOR

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	: LT1	NA	NA	NA
Function area (ft2)	: 1030			
Installed watts/ft2	:			
(times) Percent function area	:			
Total installed watts	: 780			
Daylighting analysis	: No			
Lighting system type	:			
Percent light heat to space	: 100			
'A' Classification	: .75			
'B' Classification	: B			
Diversity factors - occupied	: 25			
Diversity factors - unoccupied	: 0			
Monthly diversity table number	: 1			

PEOPLE DATA FOR ZONE 1 - FIRST FLOOR

Number of people in zone	: 4
Sensible load per person	: 230 BTUH per person
Latent load per person	: 190 BTUH per person
Diversity factor - occupied	: 40
Diversity factor - unoccupied	: 0
Monthly diversity table number	: 1

ELECTRIC EQUIPMENT DATA FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2

Electric equipment name	: ELEC EQUIP	RANGE
Total installed watts	: 500	5000
Hooded	: No	No
Diversity factors - occupied	: 10	5
Diversity factors - unoccupied	: 5	0
Monthly diversity table number	: 1	1

WALL DATA FOR ZONE 1 - FIRST FLOOR

	Wall 1	Wall 2	Wall 3	Wall 4
Name	: W1	W1	W1	W1
Wall orientation	: North	East	South	West
Area (ft2)	: 260	327	208	301
U-Factor (BTUH/ft2-deg F)	: .33	.33	.33	.33
Wall construction group	: G	G	G	G
Color correction	: Medium	Medium	Medium	Medium

ROOF DATA FOR ZONE 1 - FIRST FLOOR

	Roof 1	Roof 2
Name	: R1	NA
Area (ft2)	: 410	
U-Factor (BTUH/ft2-deg F)	: .15	
Roof construction code	: 5	
Color correction	: Dark	Light
Suspended ceiling plenum	: No	

WINDOW DATA FOR ZONE 1 - FIRST FLOOR

	Window 1	Window 2	Window 3	Window 4
Name	: G1	G1	G1	G1
Window orientation	: North	East	South	West
Fenestration area (ft2)	: 28.8	43.2	75.6	66.6
Shading coefficient	: .74	.74	.74	.74
U-Factor (BTUH/ft2-deg F)	: .49	.49	.49	.49
Space mass code	: Light	Light	Light	Light
Crack length (lin ft)	: 34	51	90	79
Leakage coefficient	: 2	2	2	2
Inputs Required for Shading				
Window shading model number	: 0	0	0	0
Percent window area	:			

DOOR (EXTERNAL) DATA FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2
Name	: D1	NA
Area (ft2)	: 42	
U-Factor (BTUH/ft2-deg F)	: .2	
Crack length (lin ft)	: 40	
Leakage coefficient	: 6	

INFILTRATION DATA FOR ZONE 1 - FIRST FLOOR

Occupied air change rate	: 0 air changes per hour
Unoccupied air change rate	: 0 air changes per hour

MISCELLANEOUS CONDUCTION FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2:
Name	: CRAWL SPACE	NA
Area (ft2)	: 940	
U-Factor (BTUH/ft2-deg F)	: .4	
Ref temperature at design summer (deg F)	: 85	
Ref temperature at design winter (deg F)	: 35	

OPERATING USE PROFILE (DIVERSITY) DATA

		Occupied Period	Unoccupied Period	Month Sched Table # (1-4)
People	- Avg % of full occupancy	: 40	0	1
Lights				
LT1	- Avg % of installed capacity	: 25	0	1
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		
Electric Equipment				
ELEC EQUIP	- Avg % of installed capacity	: 10	5	1
RANGE	- Avg % of installed capacity	: 5	0	1
Miscellaneous Sensible Loads				
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		

ZONE DATA FOR ZONE 2 - SECOND FLOOR

Zone label	: SECOND FLOOR
Zone function	:
Zone area	: 620 ft2
Floor to ceiling height	: 7.8 ft

Thermostat Set Point Temperatures

Summer occupied temperature	: 75 deg F
Winter occupied temperature	: 68 deg F
Winter unoccupied temperature	: 68 deg F

LIGHTING DATA FOR ZONE 2 - SECOND FLOOR

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	: L1	NA	NA	NA
Function area (ft2)	: 620			
Installed watts/ft2	:			
(times) Percent function area	:			
Total installed watts	: 360			
Daylighting analysis	: No			
Lighting system type	:			
Percent light heat to space	: 100			
'A' Classification	: .75			
'B' Classification	: B			
Diversity factors - occupied	: 15			
Diversity factors - unoccupied	: 0			
Monthly diversity table number	: 1			

PEOPLE DATA FOR ZONE 2 - SECOND FLOOR

Number of people in zone	: 3
Sensible load per person	: 230 BTUH per person
Latent load per person	: 190 BTUH per person
Diversity factor - occupied	: 50
Diversity factor - unoccupied	: 0
Monthly diversity table number	: 1

WALL DATA FOR ZONE 2 - SECOND FLOOR

	Wall 1	Wall 2	Wall 3	Wall 4

Name	: W1	W1	W1	W1
Wall orientation	: North	East	South	West
Area (ft2)	: 148	308	149	308
U-Factor (BTUH/ft2-deg F)	: .3	.3	.3	.3
Wall construction group	: G	G	G	G
Color correction	: Medium	Medium	Medium	Medium

ROOF DATA FOR ZONE 2 - SECOND FLOOR

	Roof 1	Roof 2
Name	: R2	NA
Area (ft2)	: 620	
U-Factor (BTUH/ft2-deg F)	: .1	
Roof construction code	: 5	
Color correction	: Dark	Light
Suspended ceiling plenum	: No	

WINDOW DATA FOR ZONE 2 - SECOND FLOOR

	Window 1	Window 2	Window 3	Window 4
Name	: G1	G1	G1	G1
Window orientation	: North	East	South	West
Fenestration area (ft2)	: 12.6	14.4	11.7	14.4
Shading coefficient	: .74	.74	.74	.74
U-Factor (BTUH/ft2-deg F)	: .49	.49	.49	.49
Space mass code	: Light	Light	Light	Light
Crack length (lin ft)	: 15	24	15	24
Leakage coefficient	: 2	2	2	2
Inputs Required for Shading				
Window shading model number	: 0	0	0	0
Percent window area	:			

INFILTRATION DATA FOR ZONE 2 - SECOND FLOOR

Occupied air change rate : 0 air changes per hour
Unoccupied air change rate : 0 air changes per hour

OPERATING USE PROFILE (DIVERSITY) DATA

Occupied Unoccupied Month Sched

		Period	Period	Table # (1-4)
People	- Avg % of full occupancy :	50	0	1
Lights				
L1	- Avg % of installed capacity :	15	0	1
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			
Electric Equipment				
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			
Miscellaneous Sensible Loads				
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			

MONTHLY DIVERSITY FACTORS

	Mon Sch 1	Mon Sch 2	Mon Sch 3	Mon Sch 4
January :	100			
February :	100			
March :	100			
April :	100			
May :	100			
June :	100			
July :	100			
August :	100			
September :	100			
October :	100			
November :	100			
December :	100			

DATA ECHO FOR LOADS INPUT FILE: GVB2.LID

BUILDING/PROJECT DATA

Building File Name	: GV100B
Building Name	: GERBER VILLAGE 100/BSMT
Project Number	: 60592.00
Building Address	: FT. BELVOIR
	: VA
Building Type	: 2 STORY/BASEMENT
Building gross floor area	: 1850 ft2
Building net conditioned area	: 1850 ft2
Number of zones	: 3
Building Location	
North latitude	: 39 deg
West longitude	: 77 deg
Time Zone Number	: 5
Daylight Savings Time	: Yes
Typical Weekday Operating Schedule	
Occupancy start hour	: 18
Operating hours/day	: 14
Summer Thermostat Schedule	
Beginning month	: May
Ending month	: October

Typical Occupied Schedule

Weekdays	from :	1800	to	800
Saturdays	from :	2000	to	1000
Sundays	from :	1600	to	800

ZONE DATA FOR ZONE 1 - FIRST FLOOR

Zone label	: FIRST FLOOR
Zone function	:
Zone area	: 1014 ft2
Floor to ceiling height	: 8.8 ft

Thermostat Set Point Temperatures

Summer occupied temperature	: 78 deg F
Winter occupied temperature	: 70 deg F
Winter unoccupied temperature	: 60 deg F

LIGHTING DATA FOR ZONE 1 - FIRST FLOOR

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	: LT1	NA	NA	NA
Function area (ft2)	: 1014			
Installed watts/ft2	:			
(times) Percent function area	:			
Total installed watts	: 900			
Daylighting analysis	: No			
Lighting system type	:			
Percent light heat to space	: 100			
'A' Classification	: .75			
'B' Classification	: B			
Diversity factors - occupied	: 25			
Diversity factors - unoccupied	: 0			
Monthly diversity table number	: 1			

PEOPLE DATA FOR ZONE 1 - FIRST FLOOR

Number of people in zone	: 4
Sensible load per person	: 230 BTUH per person
Latent load per person	: 190 BTUH per person
Diversity factor - occupied	: 40
Diversity factor - unoccupied	: 0
Monthly diversity table number	: 1

ELECTRIC EQUIPMENT DATA FOR ZONE 1 - FIRST FLOOR

Type 1	Type 2

Electric equipment name	: ELEC EQ 1	RANGE	
Total installed watts	: 500	5000	
Hooded	: No	No	
Diversity factors - occupied	: 20	5	
Diversity factors - unoccupied	: 5	0	
Monthly diversity table number	: 1	1	

WALL DATA FOR ZONE 1 - FIRST FLOOR

	Wall 1	Wall 2	Wall 3	Wall 4
Name	: W1	W1	W1	W1
Wall orientation	: North	East	South	West
Area (ft2)	: 180	226	136	275
U-Factor (BTUH/ft2-deg F)	: .33	.33	.33	.33
Wall construction group	: G	G	G	G
Color correction	: Medium	Medium	Medium	Medium

ROOF DATA FOR ZONE 1 - FIRST FLOOR

	Roof 1	Roof 2
Name	: R1	NA
Area (ft2)	: 380	
U-Factor (BTUH/ft2-deg F)	: .15	
Roof construction code	: 5	
Color correction	: Dark	Light
Suspended ceiling plenum	: No	

WINDOW DATA FOR ZONE 1 - FIRST FLOOR

	Window 1	Window 2	Window 3	Window 4
Name	: G1	G1	G1	G1
Window orientation	: North	East	South	West
Fenestration area (ft2)	: 28.8	43.2	52.2	66.6
Shading coefficient	: .74	.74	.74	.74
U-Factor (BTUH/ft2-deg F)	: .49	.49	.49	.49
Space mass code	: Light	Light	Light	Light
Crack length (lin ft)	: 34	51	90	79
Leakage coefficient	: 2	2	2	2

Inputs Required for Shading

Window shading model number	: 0	0	0	0
Percent window area	:			

DOOR (EXTERNAL) DATA FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2
Name	: D1	NA
Area (ft2)	: 42	
U-Factor (BTUH/ft2-deg F)	: .2	
Crack length (lin ft)	: 40	
Leakage coefficient	: 6	

INFILTRATION DATA FOR ZONE 1 - FIRST FLOOR

Occupied air change rate : 0 air changes per hour
Unoccupied air change rate : 0 air changes per hour

MISCELLANEOUS CONDUCTION FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2:
Name	: CRAWL SPACE	NA
Area (ft2)	: 744	
U-Factor (BTUH/ft2-deg F)	: .4	
Ref temperature at design summer (deg F)	: 85	
Ref temperature at design winter (deg F)	: 35	

OPERATING USE PROFILE (DIVERSITY) DATA

		Occupied Period	Unoccupied Period	Month Sched Table # (1-4)
People	- Avg % of full occupancy :	40	0	1
Lights				
LT1	- Avg % of installed capacity :	25	0	1
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			
Electric Equipment				
ELEC EQ 1	- Avg % of installed capacity :	20	5	1
RANGE	- Avg % of installed capacity :	5	0	1
Miscellaneous Sensible Loads				
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			

ZONE DATA FOR ZONE 2 - SECOND FLOOR

Zone label	: SECOND FLOOR
Zone function	:
Zone area	: 600 ft2
Floor to ceiling height	: 7.8 ft

Thermostat Set Point Temperatures

Summer occupied temperature	: 78 deg F
Winter occupied temperature	: 70 deg F
Winter unoccupied temperature	: 60 deg F

LIGHTING DATA FOR ZONE 2 - SECOND FLOOR

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	: L1	NA	NA	NA
Function area (ft2)	: 600			
Installed watts/ft2	:			
(times) Percent function area	:			
Total installed watts	: 375			
Daylighting analysis	: No			
Lighting system type	:			
Percent light heat to space	: 100			
'A' Classification	: .75			
'B' Classification	: B			
Diversity factors - occupied	: 15			
Diversity factors - unoccupied	: 0			
Monthly diversity table number	: 1			

PEOPLE DATA FOR ZONE 2 - SECOND FLOOR

Number of people in zone	: 2
Sensible load per person	: 230 BTUH per person
Latent load per person	: 190 BTUH per person
Diversity factor - occupied	: 50
Diversity factor - unoccupied	: 0
Monthly diversity table number	: 1

WALL DATA FOR ZONE 2 - SECOND FLOOR

	Wall 1	Wall 2	Wall 3	Wall 4

Name	: W1	W1	W1	W1
Wall orientation	: North	East	South	West
Area (ft2)	: 110	315	110	315
U-Factor (BTUH/ft2-deg F)	: .33	.33	.33	.33
Wall construction group	: G	G	G	G
Color correction	: Medium	Medium	Medium	Medium

ROOF DATA FOR ZONE 2 - SECOND FLOOR

	Roof 1	Roof 2
Name	: R2	NA
Area (ft2)	: 600	
U-Factor (BTUH/ft2-deg F)	: .1	
Roof construction code	: 5	
Color correction	: Dark	Light
Suspended ceiling plenum	: No	

WINDOW DATA FOR ZONE 2 - SECOND FLOOR

	Window 1	Window 2	Window 3	Window 4
Name	: G1	G1	G1	G1
Window orientation	: North	East	South	West
Fenestration area (ft2)	: 12.6	14.4	11.7	14.4
Shading coefficient	: .74	.74	.74	.74
U-Factor (BTUH/ft2-deg F)	: .49	.49	.49	.49
Space mass code	: Light	Light	Light	Light
Crack length (lin ft)	: 15	24	15	24
Leakage coefficient	: 2	2	2	2
Inputs Required for Shading				
Window shading model number	: 0	0	0	0
Percent window area	:			

INFILTRATION DATA FOR ZONE 2 - SECOND FLOOR

Occupied air change rate : 0 air changes per hour
Unoccupied air change rate : 0 air changes per hour

OPERATING USE PROFILE (DIVERSITY) DATA

Occupied Unoccupied Month Sched

			Period	Period	Table # (1-4)
People	- Avg % of full occupancy	:	50	0	1
Lights					
L1	- Avg % of installed capacity	:	15	0	1
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			
Electric Equipment					
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			
Miscellaneous Sensible Loads					
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			

ZONE DATA FOR ZONE 3 - BASEMENT

Zone label	: BASEMENT
Zone function	:
Zone area	: 270 ft2
Floor to ceiling height	: 7.5 ft

Thermostat Set Point Temperatures

Summer occupied temperature	: 85 deg F
Winter occupied temperature	: 50 deg F
Winter unoccupied temperature	: 45 deg F

LIGHTING DATA FOR ZONE 3 - BASEMENT

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	: L1	NA	NA	NA
Function area (ft2)	: 270			
Installed watts/ft2	:			
(times) Percent function area	:			
Total installed watts	: 60			
Daylighting analysis	: No			
Lighting system type	:			
Percent light heat to space	: 100			
'A' Classification	: .75			
'B' Classification	: B			
Diversity factors - occupied	: 2			
Diversity factors - unoccupied	: 0			
Monthly diversity table number	: 1			

WALL DATA FOR ZONE 3 - BASEMENT

	Wall 1	Wall 2	Wall 3	Wall 4
Name	: W2	W2	W2	W2
Wall orientation	: North	East	South	West
Area (ft2)	: 96	44	108	44
U-Factor (BTUH/ft2-deg F)	: .77	.77	.77	.77
Wall construction group	: C	C	C	C
Color correction	: Medium	Medium	Medium	Medium

WINDOW DATA FOR ZONE 3 - BASEMENT

	Window 1	Window 2	Window 3	Window 4
Name	: G2	NA	NA	NA
Window orientation	: South			
Fenestration area (ft2)	: 4.5			
Shading coefficient	: 1.0			
U-Factor (BTUH/ft2-deg F)	: .5			
Space mass code	: Light			
Crack length (lin ft)	: 8			
Leakage coefficient	: 2			

Inputs Required for Shading

Window shading model number	: 0
Percent window area	:

INFILTRATION DATA FOR ZONE 3 - BASEMENT

Occupied air change rate	: 0 air changes per hour
Unoccupied air change rate	: 0 air changes per hour

MISCELLANEOUS CONDUCTION FOR ZONE 3 - BASEMENT

	Type 1	Type 2:
Name	: WALLS (B.G.)	FLOOR ABOVE
Area (ft2)	: 304	270
U-Factor (BTUH/ft2-deg F)	: .77	.4
Ref temperature at design summer (deg F)	: 55	75
Ref temperature at design winter (deg F)	: 50	70

OPERATING USE PROFILE (DIVERSITY) DATA

		Occupied Period	Unoccupied Period	Month Sched Table # (1-4)
People	- Avg % of full occupancy	: 0	0	1
Lights				
L1	- Avg % of installed capacity	: 2	0	1
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		
Electric Equipment				
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		

Miscellaneous Sensible Loads

NA - Avg % of installed capacity :
NA - Avg % of installed capacity :

MONTHLY DIVERSITY FACTORS

		Mon Sch 1	Mon Sch 2	Mon Sch 3	Mon Sch 4
January	:	100			
February	:	100			
March	:	100			
April	:	100			
May	:	100			
June	:	100			
July	:	100			
August	:	100			
September	:	100			
October	:	100			
November	:	100			
December	:	100			

DATA ECHO FOR LOADS INPUT FILE: 1662.LID

BUILDING/PROJECT DATA

Building File Name	: GROUP C
Building Name	: 166-177.AREA
Project Number	: 60592.00
Building Address	: FT. BELVOIR
	: VA
Building Type	: 3 ST/3 BR TOWNHOUSE
Building gross floor area	: 1902 ft2
Building net conditioned area	: 1902 ft2
Number of zones	: 3
Building Location	
North latitude	: 39 deg
West longitude	: 77 deg
Time Zone Number	: 5
Daylight Savings Time	: Yes
Typical Weekday Operating Schedule	
Occupancy start hour	: 18
Operating hours/day	: 14
Summer Thermostat Schedule	
Beginning month	: May
Ending month	: October

Typical Occupied Schedule

Weekdays	from :	1800	to	800
Saturdays	from :	2000	to	1000
Sundays	from :	1600	to	800

ZONE DATA FOR ZONE 1 - SECOND FLOOR

Zone label	: SECOND FLOOR
Zone function	:
Zone area	: 576 ft2
Floor to ceiling height	: 8.2 ft

Thermostat Set Point Temperatures

Summer occupied temperature	: 78 deg F
Winter occupied temperature	: 70 deg F
Winter unoccupied temperature	: 60 deg F

LIGHTING DATA FOR ZONE 1 - SECOND FLOOR

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	: L1	NA	NA	NA
Function area (ft2)	: 576			
Installed watts/ft2	:			
(times) Percent function area	:			
Total installed watts	: 480			
Daylighting analysis	: No			
Lighting system type	:			
Percent light heat to space	: 100			
'A' Classification	: .75			
'B' Classification	: B			
Diversity factors - occupied	: 15			
Diversity factors - unoccupied	: 0			
Monthly diversity table number	: 1			

PEOPLE DATA FOR ZONE 1 - SECOND FLOOR

Number of people in zone	: 3
Sensible load per person	: 230 BTUH per person
Latent load per person	: 190 BTUH per person
Diversity factor - occupied	: 60
Diversity factor - unoccupied	: 0
Monthly diversity table number	: 1

WALL DATA FOR ZONE 1 - SECOND FLOOR

	Wall 1	Wall 2	Wall 3	Wall 4

Name	W1	W1	W1	W1
Wall orientation	North	East	South	West
Area (ft2)	236	132	204	132
U-Factor (BTUH/ft2-deg F)	.33	.33	.33	.33
Wall construction group	G	G	G	G
Color correction	Medium	Medium	Medium	Medium

ROOF DATA FOR ZONE 1 - SECOND FLOOR

	Roof 1	Roof 2
Name	R1	NA
Area (ft2)	576	
U-Factor (BTUH/ft2-deg F)	.4	
Roof construction code	5	
Color correction	Dark	Light
Suspended ceiling plenum	No	

WINDOW DATA FOR ZONE 1 - SECOND FLOOR

	Window 1	Window 2	Window 3	Window 4
Name	G1	G1	G1	NA
Window orientation	East	South	West	
Fenestration area (ft2)	28.8	28.8	28.8	
Shading coefficient	.79	.79	.79	
U-Factor (BTUH/ft2-deg F)	.49	.49	.49	
Space mass code	Light	Light	Light	
Crack length (lin ft)	40	40	40	
Leakage coefficient	2	2	2	
Inputs Required for Shading				
Window shading model number	0	0	0	
Percent window area				

INFILTRATION DATA FOR ZONE 1 - SECOND FLOOR

Occupied air change rate : 0 air changes per hour
Unoccupied air change rate : 0 air changes per hour

OPERATING USE PROFILE (DIVERSITY) DATA

Occupied	Unoccupied	Month Sched

		Period	Period	Table # (1-4)
People	- Avg % of full occupancy :	60	0	1
Lights				
L1	- Avg % of installed capacity :	15	0	1
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			
Electric Equipment				
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			
Miscellaneous Sensible Loads				
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			

ZONE DATA FOR ZONE 2 - FIRST FLOOR

Zone label	:	FIRST FLOOR
Zone function	:	
Zone area	:	720 ft2
Floor to ceiling height	:	8 ft

Thermostat Set Point Temperatures

Summer occupied temperature	:	75 deg F
Winter occupied temperature	:	68 deg F
Winter unoccupied temperature	:	55 deg F

LIGHTING DATA FOR ZONE 2 - FIRST FLOOR

		Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	:	L1	NA	NA	NA
Function area (ft2)	:	720			
Installed watts/ft2	:				
(times) Percent function area	:				
Total installed watts	:	580			
Daylighting analysis	:	No			
Lighting system type	:				
Percent light heat to space	:	100			
'A' Classification	:	.75			
'B' Classification	:	B			
Diversity factors - occupied	:	20			
Diversity factors - unoccupied	:	0			
Monthly diversity table number	:	1			

PEOPLE DATA FOR ZONE 2 - FIRST FLOOR

Number of people in zone	:	3
Sensible load per person	:	230 BTUH per person
Latent load per person	:	190 BTUH per person
Diversity factor - occupied	:	40
Diversity factor - unoccupied	:	0
Monthly diversity table number	:	1

ELECTRIC EQUIPMENT DATA FOR ZONE 2 - FIRST FLOOR

Type 1 Type 2

Electric equipment name	: APPLIANCES	RANGE
Total installed watts	: 500	5000
Hooded	: No	No
Diversity factors - occupied	: 20	5
Diversity factors - unoccupied	: 5	0
Monthly diversity table number	: 1	1

WALL DATA FOR ZONE 2 - FIRST FLOOR

	Wall 1	Wall 2	Wall 3	Wall 4
Name	: W1	W1	W1	W1
Wall orientation	: North	East	South	West
Area (ft2)	: 230	174	154	146
U-Factor (BTUH/ft2-deg F)	: .33	.33	.33	.33
Wall construction group	: G	G	G	G
Color correction	: Medium	Medium	Medium	Medium

ROOF DATA FOR ZONE 2 - FIRST FLOOR

	Roof 1	Roof 2
Name	: R1	NA
Area (ft2)	: 144	
U-Factor (BTUH/ft2-deg F)	: .4	
Roof construction code	: 5	
Color correction	: Dark	Light
Suspended ceiling plenum	: No	

WINDOW DATA FOR ZONE 2 - FIRST FLOOR

	Window 1	Window 2	Window 3	Window 4
Name	: G1	G1	G1	NA
Window orientation	: East	South	West	
Fenestration area (ft2)	: 17.1	68.4	84.6	
Shading coefficient	: .79	.79	.79	
U-Factor (BTUH/ft2-deg F)	: .49	.49	.49	
Space mass code	: Light	Light	Light	
Crack length (lin ft)	: 22	88	118	
Leakage coefficient	: 2	2	2	
Inputs Required for Shading				
Window shading model number	: 0	0	0	
Percent window area	:			

DOOR (EXTERNAL) DATA FOR ZONE 2 - FIRST FLOOR

	Type 1	Type 2
Name	: D1	NA
Area (ft2)	: 42	
U-Factor (BTUH/ft2-deg F)	: .2	
Crack length (lin ft)	: 40	
Leakage coefficient	: 2	

INFILTRATION DATA FOR ZONE 2 - FIRST FLOOR

Occupied air change rate : 0 air changes per hour
Unoccupied air change rate : 0 air changes per hour

MISCELLANEOUS CONDUCTION FOR ZONE 2 - FIRST FLOOR

	Type 1	Type 2:
Name	: CRAWL SPACE	OVER BSMT
Area (ft2)	: 144	576
U-Factor (BTUH/ft2-deg F)	: .4	.4
Ref temperature at design summer (deg F)	: 85	80
Ref temperature at design winter (deg F)	: 35	50

OPERATING USE PROFILE (DIVERSITY) DATA

		Occupied Period	Unoccupied Period	Month Sched Table # (1-4)
People	- Avg % of full occupancy	: 40	0	1
Lights				
L1	- Avg % of installed capacity	: 20	0	1
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		
Electric Equipment				
APPLIANCES	- Avg % of installed capacity	: 20	5	1
RANGE	- Avg % of installed capacity	: 5	0	1
Miscellaneous Sensible Loads				
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		

ZONE DATA FOR ZONE 3 - BASEMENT

Zone label	:	BASEMENT
Zone function	:	
Zone area	:	606 ft2
Floor to ceiling height	:	7.5 ft

Thermostat Set Point Temperatures

Summer occupied temperature	:	80 deg F
Winter occupied temperature	:	50 deg F
Winter unoccupied temperature	:	50 deg F

LIGHTING DATA FOR ZONE 3 - BASEMENT

		Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	:	L1	NA	NA	NA
Function area (ft2)	:	606			
Installed watts/ft2	:				
(times) Percent function area	:				
Total installed watts	:	260			
Daylighting analysis	:	No			
Lighting system type	:				
Percent light heat to space	:	100			
'A' Classification	:	.75			
'B' Classification	:	B			
Diversity factors - occupied	:	2			
Diversity factors - unoccupied	:	0			
Monthly diversity table number	:	1			

ELECTRIC EQUIPMENT DATA FOR ZONE 3 - BASEMENT

		Type 1	Type 2
Electric equipment name	:	WASHER/DRYE	NA
Total installed watts	:	200	
Hooded	:	No	
Diversity factors - occupied	:	3	
Diversity factors - unoccupied	:	0	
Monthly diversity table number	:	1	

WALL DATA FOR ZONE 3 - BASEMENT

	Wall 1	Wall 2	Wall 3	Wall 4
Name	: W2	W2	W2	W2
Wall orientation	: North	East	South	West
Area (ft2)	: 136	80	65	75
U-Factor (BTUH/ft2-deg F)	: .77	.77	.77	.77
Wall construction group	: E	E	E	E
Color correction	: Medium	Medium	Medium	Medium

WINDOW DATA FOR ZONE 3 - BASEMENT

	Window 1	Window 2	Window 3	Window 4
Name	: G1	G1	NA	NA
Window orientation	: South	West		
Fenestration area (ft2)	: 5	5		
Shading coefficient	: 1	1		
U-Factor (BTUH/ft2-deg F)	: .5	.5		
Space mass code	: Light	Light		
Crack length (lin ft)	: 9	9		
Leakage coefficient	: 2	2		
Inputs Required for Shading				
Window shading model number	: 0	0		
Percent window area	:			

DOOR (EXTERNAL) DATA FOR ZONE 3 - BASEMENT

	Type 1	Type 2
Name	: D1	NA
Area (ft2)	: 21	
U-Factor (BTUH/ft2-deg F)	: .2	
Crack length (lin ft)	: 20	
Leakage coefficient	: 2	

INFILTRATION DATA FOR ZONE 3 - BASEMENT

Occupied air change rate : 0 air changes per hour
Unoccupied air change rate : 0 air changes per hour

OPERATING USE PROFILE (DIVERSITY) DATA

	Occupied	Unoccupied	Month Sched

			Period	Period	Table # (1-4)
People	- Avg % of full occupancy	:	0	0	1
Lights					
L1	- Avg % of installed capacity	:	2	0	1
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			
Electric Equipment					
WASHER/DRYER	- Avg % of installed capacity	:	3	0	1
NA	- Avg % of installed capacity	:			
Miscellaneous Sensible Loads					
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			

MONTHLY DIVERSITY FACTORS

		Mon Sch 1	Mon Sch 2	Mon Sch 3	Mon Sch 4
January	:	100			
February	:	100			
March	:	100			
April	:	100			
May	:	100			
June	:	100			
July	:	100			
August	:	100			
September	:	100			
October	:	100			
November	:	100			
December	:	100			

DATA ECHO FOR LOADS INPUT FILE: 40T2.LID

BUILDING/PROJECT DATA

Building File Name	:	400T
Building Name	:	400 AREA T SHAPE
Project Number	:	60592.00
Building Address	:	FT. BELVOIR
	:	VA
Building Type	:	1-STORY 3-BR HOUSE
Building gross floor area	:	1592 ft2
Building net conditioned area	:	1592 ft2
Number of zones	:	1
Building Location		
North latitude	:	39 deg
West longitude	:	77 deg
Time Zone Number	:	5
Daylight Savings Time	:	Yes
Typical Weekday Operating Schedule		
Occupancy start hour	:	18
Operating hours/day	:	14
Summer Thermostat Schedule		
Beginning month	:	May
Ending month	:	October

Typical Occupied Schedule

Weekdays	from :	1800	to	800
Saturdays	from :	2000	to	1000
Sundays	from :	1600	to	800

ZONE DATA FOR ZONE 1 - FIRST FLOOR

Zone label	: FIRST FLOOR
Zone function	:
Zone area	: 1592 ft2
Floor to ceiling height	: 9 ft

Thermostat Set Point Temperatures

Summer occupied temperature	: 75 deg F
Winter occupied temperature	: 68 deg F
Winter unoccupied temperature	: 55 deg F

LIGHTING DATA FOR ZONE 1 - FIRST FLOOR

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	: L1	NA	NA	NA
Function area (ft2)	: 1592			
Installed watts/ft2	:			
(times) Percent function area	:			
Total installed watts	: 1070			
Daylighting analysis	: No			
Lighting system type	:			
Percent light heat to space	: 100			
'A' Classification	: .75			
'B' Classification	: B			
Diversity factors - occupied	: 20			
Diversity factors - unoccupied	: 0			
Monthly diversity table number	: 1			

PEOPLE DATA FOR ZONE 1 - FIRST FLOOR

Number of people in zone	: 4
Sensible load per person	: 230 BTUH per person
Latent load per person	: 190 BTUH per person
Diversity factor - occupied	: 40
Diversity factor - unoccupied	: 0
Monthly diversity table number	: 1

ELECTRIC EQUIPMENT DATA FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2

Electric equipment name	: ELEC EQ	RANGE
Total installed watts	: 500	5000
Hooded	: No	No
Diversity factors - occupied	: 20	5
Diversity factors - unoccupied	: 5	0
Monthly diversity table number	: 1	1

WALL DATA FOR ZONE 1 - FIRST FLOOR

	Wall 1	Wall 2	Wall 3	Wall 4
Name	: W1	W1	W1	W1
Wall orientation	: North	East	South	West
Area (ft2)	: 196	500	204	484
U-Factor (BTUH/ft2-deg F)	: .33	.33	.33	.33
Wall construction group	: G	G	G	G
Color correction	: Medium	Medium	Medium	Medium

ROOF DATA FOR ZONE 1 - FIRST FLOOR

	Roof 1	Roof 2
Name	: R1	NA
Area (ft2)	: 1592	
U-Factor (BTUH/ft2-deg F)	: .05	
Roof construction code	: 5	
Color correction	: Dark	Light
Suspended ceiling plenum	: No	

WINDOW DATA FOR ZONE 1 - FIRST FLOOR

	Window 1	Window 2	Window 3	Window 4
Name	: G1	G1	G1	G1
Window orientation	: North	East	South	West
Fenestration area (ft2)	: 21.6	38.7	14.4	64.8
Shading coefficient	: .87	.87	.39	.39
U-Factor (BTUH/ft2-deg F)	: .49	.49	.49	.49
Space mass code	: Light	Light	Light	Light
Crack length (lin ft)	: 42	74	28	126
Leakage coefficient	: 2	2	2	2

Inputs Required for Shading

Window shading model number	: 0	0	0	0
Percent window area	:			

DOOR (EXTERNAL) DATA FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2
Name	: D1	NA
Area (ft2)	: 63	
U-Factor (BTUH/ft2-deg F)	: .2	
Crack length (lin ft)	: 46	
Leakage coefficient	: 2	

INFILTRATION DATA FOR ZONE 1 - FIRST FLOOR

Occupied air change rate	: 0 air changes per hour
Unoccupied air change rate	: 0 air changes per hour

MISCELLANEOUS CONDUCTION FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2:
Name	: CRAWL SPACE	NA
Area (ft2)	: 1592	
U-Factor (BTUH/ft2-deg F)	: .1	
Ref temperature at design summer (deg F)	: 85	
Ref temperature at design winter (deg F)	: 35	

OPERATING USE PROFILE (DIVERSITY) DATA

		Occupied Period	Unoccupied Period	Month Sched Table # (1-4)
People	- Avg % of full occupancy	: 40	0	1
Lights				
L1	- Avg % of installed capacity	: 20	0	1
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		
Electric Equipment				
ELEC EQ	- Avg % of installed capacity	: 20	5	1
RANGE	- Avg % of installed capacity	: 5	0	1
Miscellaneous Sensible Loads				
NA	- Avg % of installed capacity	:		
NA	- Avg % of installed capacity	:		

MONTHLY DIVERSITY FACTORS

Mon Sch 1	Mon Sch 2	Mon Sch 3	Mon Sch 4

January	:	100
February	:	100
March	:	100
April	:	100
May	:	100
June	:	100
July	:	100
August	:	100
September	:	100
October	:	100
November	:	100
December	:	100

DATA ECHO FOR LOADS INPUT FILE: 40L2.LID

BUILDING/PROJECT DATA

```
Building File Name              : 400L
Building Name                   : 400 AREA L SHAPE
Project Number                  : 60592.00

Building Address                : FT. BELVOIR
                                : VA

Building Type                   : 1-STORY 4 BR HOUSE

Building gross floor area       : 2020 ft2
Building net conditioned area   : 2020 ft2
Number of zones                 : 1

Building Location
  North latitude                : 39 deg
  West longitude                : 77 deg
  Time Zone Number              : 5
  Daylight Savings Time         : Yes

Typical Weekday Operating Schedule
  Occupancy start hour          : 18
  Operating hours/day           : 14

Summer Thermostat Schedule
  Beginning month               : May
  Ending month                  : October

Typical Occupied Schedule
  Weekdays ............... from : 1800  to   800
  Saturdays .............. from : 2000  to  1000
  Sundays ................ from : 1600  to   800
```

ZONE DATA FOR ZONE 1 - FIRST FLOOR

Zone label	: FIRST FLOOR
Zone function	:
Zone area	: 2020 ft2
Floor to ceiling height	: 9 ft
Thermostat Set Point Temperatures	
Summer occupied temperature	: 75 deg F
Winter occupied temperature	: 68 deg F
Winter unoccupied temperature	: 55 deg F

LIGHTING DATA FOR ZONE 1 - FIRST FLOOR

	Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	: L1	NA	NA	NA
Function area (ft2)	: 2020			
Installed watts/ft2	:			
(times) Percent function area	:			
Total installed watts	: 1200			
Daylighting analysis	: No			
Lighting system type	:			
Percent light heat to space	: 100			
'A' Classification	: .75			
'B' Classification	: B			
Diversity factors - occupied	: 20			
Diversity factors - unoccupied	: 0			
Monthly diversity table number	: 1			

PEOPLE DATA FOR ZONE 1 - FIRST FLOOR

Number of people in zone	: 5
Sensible load per person	: 230 BTUH per person
Latent load per person	: 190 BTUH per person
Diversity factor - occupied	: 60
Diversity factor - unoccupied	: 0
Monthly diversity table number	: 1

ELECTRIC EQUIPMENT DATA FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2

DATA ECHO FOR LOADS INPUT FILE: RV2.LID

BUILDING/PROJECT DATA

```
Building File Name                : RV1600
Building Name                     : RIVER VILLAGE 1600
Project Number                    : 60592.00

Building Address                  : FT. BELVOIR
                                  : VA

Building Type                     : 2-STORY 3 BR TOWNHOUSE

Building gross floor area         : 1380 ft2
Building net conditioned area     : 1380 ft2
Number of zones                   : 2

Building Location
  North latitude                  : 39 deg
  West longitude                  : 77 deg
  Time Zone Number                : 5
  Daylight Savings Time           : Yes

Typical Weekday Operating Schedule
  Occupancy start hour            : 18
  Operating hours/day             : 14

Summer Thermostat Schedule
  Beginning month                 : May
  Ending month                    : October

Typical Occupied Schedule
  Weekdays ............... from : 1800  to   800
  Saturdays .............. from : 2000  to  1000
  Sundays ................ from : 1600  to   800
```

ZONE DATA FOR ZONE 1 - FIRST FLOOR

Zone label	:	FIRST FLOOR
Zone function	:	
Zone area	:	690 ft2
Floor to ceiling height	:	7.8 ft

Thermostat Set Point Temperatures

Summer occupied temperature	:	75 deg F
Winter occupied temperature	:	68 deg F
Winter unoccupied temperature	:	55 deg F

LIGHTING DATA FOR ZONE 1 - FIRST FLOOR

		Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	:	LT1	NA	NA	NA
Function area (ft2)	:	690			
Installed watts/ft2	:				
(times) Percent function area	:				
Total installed watts	:	600			
Daylighting analysis	:	No			
Lighting system type	:				
Percent light heat to space	:	100			
'A' Classification	:	.75			
'B' Classification	:	B			
Diversity factors - occupied	:	20			
Diversity factors - unoccupied	:	0			
Monthly diversity table number	:	1			

PEOPLE DATA FOR ZONE 1 - FIRST FLOOR

Number of people in zone	:	3
Sensible load per person	:	230 BTUH per person
Latent load per person	:	190 BTUH per person
Diversity factor - occupied	:	40
Diversity factor - unoccupied	:	0
Monthly diversity table number	:	1

ELECTRIC EQUIPMENT DATA FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2

Electric equipment name	: ELEC EQUIP	RANGE
Total installed watts	: 500	5000
Hooded	: No	No
Diversity factors - occupied	: 20	5
Diversity factors - unoccupied	: 5	0
Monthly diversity table number	: 1	1

WALL DATA FOR ZONE 1 - FIRST FLOOR

	Wall 1	Wall 2	Wall 3	Wall 4
Name	: W1	W1	NA	W1
Wall orientation	: North	East		West
Area (ft2)	: 187	156		159
U-Factor (BTUH/ft2-deg F)	: .1	.1		.1
Wall construction group	: G	G		G
Color correction	: Medium	Medium	Medium	Medium

WINDOW DATA FOR ZONE 1 - FIRST FLOOR

	Window 1	Window 2	Window 3	Window 4
Name	: G1	G1	NA	G1
Window orientation	: North	East		West
Fenestration area (ft2)	: 4.5	12.6		26.1
Shading coefficient	: .74	.74		.74
U-Factor (BTUH/ft2-deg F)	: .49	.49		.49
Space mass code	: Light	Light		Light
Crack length (lin ft)	: 11	59		46
Leakage coefficient	: 2	2		2
Inputs Required for Shading				
Window shading model number	: 0	0		0
Percent window area	:			

DOOR (EXTERNAL) DATA FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2
Name	: D1	NA
Area (ft2)	: 84	
U-Factor (BTUH/ft2-deg F)	: .2	
Crack length (lin ft)	: 73	
Leakage coefficient	: 6	

INFILTRATION DATA FOR ZONE 1 - FIRST FLOOR

Occupied air change rate : 0 air changes per hour
Unoccupied air change rate : 0 air changes per hour

MISCELLANEOUS CONDUCTION FOR ZONE 1 - FIRST FLOOR

	Type 1	Type 2:
Name	: CRAWL SPACE	NA
Area (ft2)	: 690	
U-Factor (BTUH/ft2-deg F)	: .1	
Ref temperature at design summer (deg F)	: 85	
Ref temperature at design winter (deg F)	: 35	

OPERATING USE PROFILE (DIVERSITY) DATA

		Occupied Period	Unoccupied Period	Month Sched Table # (1-4)
People	- Avg % of full occupancy :	40	0	1
Lights				
LT1	- Avg % of installed capacity :	20	0	1
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			
Electric Equipment				
ELEC EQUIP	- Avg % of installed capacity :	20	5	1
RANGE	- Avg % of installed capacity :	5	0	1
Miscellaneous Sensible Loads				
NA	- Avg % of installed capacity :			
NA	- Avg % of installed capacity :			

ZONE DATA FOR ZONE 2 - SECOND FLOOR

Zone label	:	SECOND FLOOR
Zone function	:	
Zone area	:	690 ft2
Floor to ceiling height	:	8 ft

Thermostat Set Point Temperatures

Summer occupied temperature	:	75 deg F
Winter occupied temperature	:	68 deg F
Winter unoccupied temperature	:	55 deg F

LIGHTING DATA FOR ZONE 2 - SECOND FLOOR

		Ltg Func 1	Ltg Func 2	Ltg Func 3	Ltg Func 4
Function name	:	L1	NA	NA	NA
Function area (ft2)	:	690			
Installed watts/ft2	:				
(times) Percent function area	:				
Total installed watts	:	600			
Daylighting analysis	:	No			
Lighting system type	:				
Percent light heat to space	:	100			
'A' Classification	:	.75			
'B' Classification	:	B			
Diversity factors - occupied	:	15			
Diversity factors - unoccupied	:	0			
Monthly diversity table number	:	1			

PEOPLE DATA FOR ZONE 2 - SECOND FLOOR

Number of people in zone	:	3
Sensible load per person	:	230 BTUH per person
Latent load per person	:	190 BTUH per person
Diversity factor - occupied	:	60
Diversity factor - unoccupied	:	0
Monthly diversity table number	:	1

WALL DATA FOR ZONE 2 - SECOND FLOOR

	Wall 1	Wall 2	Wall 3	Wall 4

Name	: W1	W1	NA	W1
Wall orientation	: North	East		West
Area (ft2)	: 200	179		183
U-Factor (BTUH/ft2-deg F)	: .1	.1		.1
Wall construction group	: G	G		G
Color correction	: Medium	Medium	Medium	Medium

ROOF DATA FOR ZONE 2 - SECOND FLOOR

	Roof 1	Roof 2
Name	: R1	NA
Area (ft2)	: 690	
U-Factor (BTUH/ft2-deg F)	: .05	
Roof construction code	: 5	
Color correction	: Dark	Light
Suspended ceiling plenum	: No	

WINDOW DATA FOR ZONE 2 - SECOND FLOOR

	Window 1	Window 2	Window 3	Window 4
Name	: G1	G1	NA	G1
Window orientation	: North	East		West
Fenestration area (ft2)	: 7.2	29.7		26.1
Shading coefficient	: .74	.74		.74
U-Factor (BTUH/ft2-deg F)	: .49	.49		.49
Space mass code	: Light	Light		Light
Crack length (lin ft)	: 14	57		46
Leakage coefficient	: 2	2		2
Inputs Required for Shading				
Window shading model number	: 0	0		0
Percent window area	:			

INFILTRATION DATA FOR ZONE 2 - SECOND FLOOR

Occupied air change rate : 0 air changes per hour
Unoccupied air change rate : 0 air changes per hour

OPERATING USE PROFILE (DIVERSITY) DATA

	Occupied	Unoccupied	Month Sched

			Period	Period	Table # (1-4)
People	- Avg % of full occupancy	:	60	0	1
Lights					
L1	- Avg % of installed capacity	:	15	0	1
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			
Electric Equipment					
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			
Miscellaneous Sensible Loads					
NA	- Avg % of installed capacity	:			
NA	- Avg % of installed capacity	:			

MONTHLY DIVERSITY FACTORS

		Mon Sch 1	Mon Sch 2	Mon Sch 3	Mon Sch 4
January	:	100			
February	:	100			
March	:	100			
April	:	100			
May	:	100			
June	:	100			
July	:	100			
August	:	100			
September	:	100			
October	:	100			
November	:	100			
December	:	100			

ASEAM System Input

(Typical for All Buildings)

DATA ECHO FOR SYSTEMS INPUT FILE - 400T.SID
SYSTEM TYPE - CONSTANT VOLUME REHEAT
SYSTEM LABEL - DX COOLING WITH GAS HEATING

ZONES ASSIGNED TO SYSTEM 1 - DX COOLING WITH GAS HEATING

Load Zone	Zone Label
1	FIRST FLOOR

HEATING PARAMETERS FOR SYSTEM 1 - DX COOLING WITH GAS HEATING

Heating plant type	: Furnace
Heating available below	: 65 deg F
Heating availability	: Nov through Apr
Design heating discharge temperature	: 110 deg F

COOLING PARAMETERS FOR SYSTEM 1 - DX COOLING WITH GAS HEATING

Cooling plant type	: Direct Expansion
Outside temperature below which cooling is off	: 55 deg F
Cooling availability	: Apr through Oct
Design cooling coil discharge temperature	: 60 deg F
Discriminator control	: No

PREHEAT PARAMETERS FOR SYSTEM 1 - DX COOLING WITH GAS HEATING

Preheat plant type	: None

HUMIDIFICATION PARAMETERS FOR SYSTEM 1 - DX COOLING WITH GAS HEATING

Humidification plant type	: None

BASEBOARD PARAMETERS FOR SYSTEM 1 - DX COOLING WITH GAS HEATING

Baseboard plant type	: None

FAN PARAMETERS FOR SYSTEM 1 - DX COOLING WITH GAS HEATING

Total supply fan power required	: Defaulted
Supply fan temperature rise	: Defaulted

Total return fan power required	: 0 KW
Return fan temperature rise	: Defaulted
Unoccupied cycle fan control method	: Cycles with Load

OUTSIDE AIR PARAMETERS FOR SYSTEM 1 - DX COOLING WITH GAS HEATING

Occupied Cycle	
Outside air damper control method	: No Outside Air
Unoccupied Cycle	
Outside air damper control method	: No Outside Air

FURNACE PARAMETERS FOR SYSTEM 1 - DX COOLING WITH GAS HEATING

Furnace fuel source	: Natural Gas
Furnace capacity	: Autosized
Percent of design load satisfied	: 100 %
Furnace efficiency at design load	: 75 %
Losses as percent of design load (at design load)	: 2 %
Losses as percent of design load (at no load)	: 0 %

ZONE AIR PARAMETERS FOR SYSTEM 1 - DX COOLING WITH GAS HEATING

Zonal air volume method	: Autosized
Percent of design default air flow	: 100 %

DIRECT EXPANSION COOLING PARAMETERS FOR SYSTEM 1 - DX COOLING WITH GAS HEATING

DX total cooling capacity	: Autosized
Percent of design total load satisfied	: 80 %
Design coefficient of performance	: 3.0
Minimum unloading ratio (% of capacity)	: 100 %
Minimum hot gas bypass ratio (% of capacity)	: 100 %
Condenser fan KW	: Defaulted
Outside temperature below which condenser fan is off	: 45 deg F

ASEAM Plant Input

(Typical for all Buildings)

DATA ECHO FOR PLANT INPUT FILE: GV1A.PID

ENERGY COSTS/CONVERSIONS

Fuel Type	Energy Units	Unit Cost	Conversion Factors (BTU/Unit) Site	Source
Electricity	KWH	$0.0600	3,413	0
Natural Gas	Therms	$0.6079	100,000	0

MISCELLANEOUS ENERGY CONSUMPTION

Label	Fuel Type	Annual Consumption
DRYER	Electricity	1,100.0 KWH

DOMESTIC HOT WATER

Domestic Hot Water Energy Source	: Natural Gas
Annual pilot consumption	: 1 therms
Domestic Hot Water Heating Capacity	: Autosized
Peak hourly DHW usage	: 120 gal/hour
Average hourly DHW usage - occupied cycle	: 10 gal/hour
Average hourly DHW usage - unoccupied cycle	: 0 gal/hour
DHW Temperatures	
Domestic how water supply temperature	: 110 deg F
DHW inlet temperature - design summer	: 75 deg F
DHW inlet temperature - design winter	: 50 deg F
Circulating Pumps	
Circulating pump KW - occupied cycle	: 0 KW
Circulating pump KW - unoccupied cycle	: 0 KW
Domestic Hot Water Efficiency and Losses	
Design DHW heating efficiency	: 70 %
DHW losses - occupied cycle	: 200 BTUH
DHW losses - unoccupied cycle	: 100 BTUH

Appendix D

ASEAM Output

ASEAM OUTPUTS
GV 100 AREA (NO. BSMT.)

1. BASELINE

2. INSULATE WALLS

3. INSULATE CRAWL SPACE

4. REPLACE LIGHT FIXTURES

5. REACTIVATE WHOLE HOUSE FANS AND INSTALL PROGRAMMABLE THERMOSTATS

6. MULTIPLE ECOs

ASEAM3 Report: Monthly Energy Consumption HIGH Date: 12-28-1994

GERBER VILLAGE 100 AREA - NO BASEMENT
BASELINE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	282	0	2,997	0.0	0.0
Feb	215	0	2,703	0.0	0.0
Mar	163	0	2,912	0.0	0.0
Apr	81	0	3,437	0.0	0.0
May	38	0	4,436	0.0	0.0
Jun	36	0	4,984	0.0	0.0
Jul	36	0	5,385	0.0	0.0
Aug	37	0	5,348	0.0	0.0
Sep	36	0	4,656	0.0	0.0
Oct	39	0	3,801	0.0	0.0
Nov	137	0	2,810	0.0	0.0
Dec	245	0	3,011	0.0	0.0
Ann	1,346	0	46,479	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	282	0	2,997	0.0	0.0
Feb	498	0	5,700	0.0	0.0
Mar	661	0	8,611	0.0	0.0
Apr	742	0	12,049	0.0	0.0
May	780	0	16,485	0.0	0.0
Jun	816	0	21,469	0.0	0.0
Jul	852	0	26,854	0.0	0.0
Aug	889	0	32,202	0.0	0.0
Sep	924	0	36,857	0.0	0.0
Oct	963	0	40,658	0.0	0.0
Nov	1,100	0	43,468	0.0	0.0
Dec	1,346	0	46,479	0.0	0.0

Fans		[illegible]	[illegible]
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,346	46,479	
Unit Cost	$0.608	$0.060	
Dollar Cost	$818	$2,789	$3,607
Site Energy (MBTU)	134.6	158.6	293.2
Source Energy (MBTU)		0.0	0.0

ASEAM3 Report: Monthly Energy Consumption   Date: 06-13-1994

GERBER VILLAGE 100 AREA WITH NO BASEMENT
INSULATE WALLS WITH 1-INCH BLOWNIN INSULATION

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	215	0	2,616	0.0	0.0
Feb	164	0	2,361	0.0	0.0
Mar	126	0	2,547	0.0	0.0
Apr	58	0	2,418	0.0	0.0
May	38	0	3,879	0.0	0.0
Jun	36	0	4,353	0.0	0.0
Jul	36	0	4,701	0.0	0.0
Aug	37	0	4,669	0.0	0.0
Sep	36	0	4,068	0.0	0.0
Oct	39	0	3,328	0.0	0.0
Nov	103	0	2,462	0.0	0.0
Dec	185	0	2,629	0.0	0.0
Ann	1,073	0	40,031	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	215	0	2,616	0.0	0.0
Feb	380	0	4,977	0.0	0.0
Mar	506	0	7,525	0.0	0.0
Apr	564	0	9,943	0.0	0.0
May	602	0	13,821	0.0	0.0
Jun	637	0	18,174	0.0	0.0
Jul	673	0	22,875	0.0	0.0
Aug	710	0	27,544	0.0	0.0
Sep	746	0	31,612	0.0	0.0
Oct	785	0	34,940	0.0	0.0
Nov	887	0	37,402	0.0	0.0
Dec	1,073	0	40,031	0.0	0.0

GERBER VILLAGE 100 AREA WITH NO BASEMENT
INSULATE WALLS WITH 1-INCH BLOWNIN INSULATION

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	616		61.64
Cooling Energy			
Direct Expansion		10,253	34.99
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,299	4.43
Equipment		1,654	5.64
System Miscellaneous			
Fans		25,725	87.80
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,073	40,031	
Unit Cost	$0.608	$0.060	
Dollar Cost	$652	$2,402	$3,054
Site Energy (MBTU)	107.3	136.6	243.9
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GERBER VILLAGE 100 AREA WITH NO BASEMENT
INSULATE WALLS WITH 1-INCH BLOWNIN INSULATION

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,346	1,073	273	20.3
Electricity	kWh	45,796	40,031	5,765	12.6
Gas	Dollars	818	652	166	20.3
Electricity	Dollars	2,748	2,402	346	12.6
Annual Totals	Dollars	3,566	3,054	512	14.4
Gas	MBTU	134.566	107.282	27.284	20.3
Electricity	MBTU	156.302	136.626	19.675	12.6
Annual Totals	MBTU	290.868	243.908	46.959	16.1

ASEAM3 Report: Monthly Energy Consumption   Date: 06-03-1994

GERBER VILLAGE 100 AREA - NO BASEMENT
INSULATE FLOOR OVER CRAWL SPACE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	246	0	2,865	0.0	0.0
Feb	187	0	2,585	0.0	0.0
Mar	142	0	2,784	0.0	0.0
Apr	74	0	3,284	0.0	0.0
May	38	0	4,236	0.0	0.0
Jun	36	0	4,757	0.0	0.0
Jul	36	0	5,139	0.0	0.0
Aug	37	0	5,103	0.0	0.0
Sep	36	0	4,444	0.0	0.0
Oct	39	0	3,631	0.0	0.0
Nov	121	0	2,687	0.0	0.0
Dec	214	0	2,879	0.0	0.0
Ann	1,204	0	44,395	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	246	0	2,865	0.0	0.0
Feb	432	0	5,450	0.0	0.0
Mar	575	0	8,235	0.0	0.0
Apr	649	0	11,519	0.0	0.0
May	686	0	15,755	0.0	0.0
Jun	722	0	20,512	0.0	0.0
Jul	758	0	25,650	0.0	0.0
Aug	795	0	30,754	0.0	0.0
Sep	831	0	35,198	0.0	0.0
Oct	870	0	38,829	0.0	0.0
Nov	990	0	41,516	0.0	0.0
Dec	1,204	0	44,395	0.0	0.0

GERBER VILLAGE 100 AREA - NO BASEMENT
INSULATE FLOOR OVER CRAWL SPACE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	748		74.79
Cooling Energy			
Direct Expansion		11,918	40.67
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,299	4.43
Equipment		1,654	5.64
System Miscellaneous			
Fans		28,425	97.01
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,204	44,395	
Unit Cost	$0.608	$0.060	
Dollar Cost	$732	$2,664	$3,396
Site Energy (MBTU)	120.4	151.5	271.9
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GERBER VILLAGE 100 AREA - NO BASEMENT
INSULATE FLOOR OVER CRAWL SPACE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,346	1,204	141	10.5
Electricity	kWh	46,479	44,395	2,084	4.5
Gas	Dollars	818	732	86	10.5
Electricity	Dollars	2,789	2,664	125	4.5
Annual Totals	Dollars	3,607	3,396	211	5.9
Gas	MBTU	134.566	120.424	14.142	10.5
Electricity	MBTU	158.632	151.519	7.113	4.5
Annual Totals	MBTU	293.198	271.943	21.255	7.2

ASEAM3 Report: Monthly Energy Consumption Date: 12-28-1994

GERBER VILLAGE 100 AREA - NO BASEMENT
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	285	0	2,943	0.0	0.0
Feb	217	0	2,655	0.0	0.0
Mar	165	0	2,859	0.0	0.0
Apr	82	0	3,381	0.0	0.0
May	38	0	4,370	0.0	0.0
Jun	36	0	4,914	0.0	0.0
Jul	36	0	5,311	0.0	0.0
Aug	37	0	5,274	0.0	0.0
Sep	36	0	4,589	0.0	0.0
Oct	39	0	3,741	0.0	0.0
Nov	138	0	2,759	0.0	0.0
Dec	248	0	2,957	0.0	0.0
Ann	1,356	0	45,753	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	285	0	2,943	0.0	0.0
Feb	502	0	5,599	0.0	0.0
Mar	667	0	8,457	0.0	0.0
Apr	749	0	11,838	0.0	0.0
May	787	0	16,209	0.0	0.0
Jun	822	0	21,123	0.0	0.0
Jul	858	0	26,434	0.0	0.0
Aug	895	0	31,707	0.0	0.0
Sep	931	0	36,296	0.0	0.0
Oct	970	0	40,037	0.0	0.0
Nov	1,108	0	42,795	0.0	0.0
Dec	1,356	0	45,753	0.0	0.0

GERBER VILLAGE 100 AREA - NO BASEMENT
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	899		89.94
Cooling Energy			
Direct Expansion		12,411	42.36
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		951	3.24
Equipment		1,654	5.64
System Miscellaneous			
Fans		29,637	101.15
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,356	45,753	
Unit Cost	$0.608	$0.060	
Dollar Cost	$824	$2,745	$3,569
Site Energy (MBTU)	135.6	156.2	291.7
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GERBER VILLAGE 100 AREA - NO BASEMENT
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,346	1,356	-10	-0.8
Electricity	kWh	46,479	45,753	726	1.6
Gas	Dollars	818	824	-6	-0.8
Electricity	Dollars	2,789	2,745	44	1.6
Annual Totals	Dollars	3,607	3,569	37	1.0
Gas	MBTU	134.566	135.582	-1.017	-0.8
Electricity	MBTU	158.632	156.155	2.478	1.6
Annual Totals	MBTU	293.198	291.737	1.461	0.5

ASEAM3 Report: Monthly Energy Consumption Date: 12-27-1994

GERBER VILLAGE 100 AREA NO BASEMENT
REACTIVATE WHOLE HOUSE FAN/INSTALL PROGRAMMABLE T'STAT

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	255	0	2,267	0.0	0.0
Feb	196	0	2,053	0.0	0.0
Mar	145	0	2,235	0.0	0.0
Apr	64	0	2,696	0.0	0.0
May	38	0	3,869	0.0	0.0
Jun	36	0	4,454	0.0	0.0
Jul	36	0	4,845	0.0	0.0
Aug	37	0	4,804	0.0	0.0
Sep	36	0	4,118	0.0	0.0
Oct	39	0	3,219	0.0	0.0
Nov	122	0	2,168	0.0	0.0
Dec	221	0	2,284	0.0	0.0
Ann	1,225	0	39,012	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	255	0	2,267	0.0	0.0
Feb	452	0	4,320	0.0	0.0
Mar	596	0	6,555	0.0	0.0
Apr	660	0	9,251	0.0	0.0
May	698	0	13,119	0.0	0.0
Jun	734	0	17,573	0.0	0.0
Jul	770	0	22,418	0.0	0.0
Aug	807	0	27,222	0.0	0.0
Sep	843	0	31,340	0.0	0.0
Oct	882	0	34,560	0.0	0.0
Nov	1,004	0	36,727	0.0	0.0
Dec	1,225	0	39,012	0.0	0.0

GERBER VILLAGE 100 AREA NO BASEMENT
REACTIVATE WHOLE HOUSE FAN/INSTALL PROGRAMMABLE T'STAT

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	769		76.87
Cooling Energy			
Direct Expansion		12,643	43.15
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,299	4.43
Equipment		1,654	5.64
System Miscellaneous			
Fans		22,317	76.17
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,225	39,012	
Unit Cost	$0.608	$0.060	
Dollar Cost	$745	$2,341	$3,085
Site Energy (MBTU)	122.5	133.1	255.7
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GERBER VILLAGE 100 AREA NO BASEMENT
REACTIVATE WHOLE HOUSE FAN/INSTALL PROGRAMMABLE T'STAT

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,346	1,225	121	9.0
Electricity	kWh	46,479	39,012	7,467	16.1
Gas	Dollars	818	745	73	9.0
Electricity	Dollars	2,789	2,341	448	16.1
Annual Totals	Dollars	3,607	3,085	521	14.5
Gas	MBTU	134.566	122.512	12.054	9.0
Electricity	MBTU	158.632	133.147	25.486	16.1
Annual Totals	MBTU	293.198	255.659	37.539	12.8

ASEAM3 Report: Monthly Energy Consumption Date: 12-27-1994

GERBER VILLAGE 100 AREA - NO BASEMENT
MULTIPLE ECO'S

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	128	0	1,622	0.0	0.0
Feb	95	0	1,473	0.0	0.0
Mar	75	0	1,608	0.0	0.0
Apr	47	0	1,926	0.0	0.0
May	38	0	2,747	0.0	0.0
Jun	36	0	3,156	0.0	0.0
Jul	36	0	3,429	0.0	0.0
Aug	37	0	3,400	0.0	0.0
Sep	36	0	2,921	0.0	0.0
Oct	39	0	2,295	0.0	0.0
Nov	66	0	1,561	0.0	0.0
Dec	110	0	1,636	0.0	0.0
Ann	742	0	27,774	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	128	0	1,622	0.0	0.0
Feb	223	0	3,095	0.0	0.0
Mar	298	0	4,703	0.0	0.0
Apr	345	0	6,629	0.0	0.0
May	383	0	9,376	0.0	0.0
Jun	418	0	12,532	0.0	0.0
Jul	454	0	15,961	0.0	0.0
Aug	491	0	19,361	0.0	0.0
Sep	527	0	22,282	0.0	0.0
Oct	566	0	24,578	0.0	0.0
Nov	632	0	26,139	0.0	0.0
Dec	742	0	27,774	0.0	0.0

GERBER VILLAGE 100 AREA - NO BASEMENT
MULTIPLE ECO'S

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	286		28.59
Cooling Energy			
Direct Expansion		8,794	30.01
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		951	3.24
Equipment		1,654	5.64
System Miscellaneous			
Fans		15,277	52.14
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	742	27,774	
Unit Cost	$0.608	$0.060	
Dollar Cost	$451	$1,666	$2,118
Site Energy (MBTU)	74.2	94.8	169.0
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GERBER VILLAGE 100 AREA - NO BASEMENT
MULTIPLE ECO'S

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,346	742	603	44.8
Electricity	kWh	46,479	27,774	18,704	40.2
Gas	Dollars	818	451	367	44.8
Electricity	Dollars	2,789	1,666	1,122	40.2
Annual Totals	Dollars	3,607	2,118	1,489	41.3
Gas	MBTU	134.566	74.224	60.342	44.8
Electricity	MBTU	158.632	94.794	63.838	40.2
Annual Totals	MBTU	293.198	169.018	124.180	42.4

ASEAM OUTPUTS
GV 100 AREA WITH BSMT.

1. BASELINE

2. INSULATE WALLS

3. INSULATE CRAWL SPACE

4. REPLACE LIGHT FIXTURES

5. REACTIVATE WHOLE HOUSE FANS AND INSTALL PROGRAMMABLE THERMOSTATS

6. MULTIPLE ECOs

GERBER VILLAGE 100 AREA WITH BASEMENT
BASELINE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	280	0	2,897	0.0	0.0
Feb	212	0	2,604	0.0	0.0
Mar	157	0	2,788	0.0	0.0
Apr	77	0	2,624	0.0	0.0
May	38	0	4,187	0.0	0.0
Jun	36	0	4,695	0.0	0.0
Jul	36	0	5,070	0.0	0.0
Aug	37	0	5,035	0.0	0.0
Sep	36	0	4,389	0.0	0.0
Oct	39	0	3,596	0.0	0.0
Nov	131	0	2,686	0.0	0.0
Dec	241	0	2,901	0.0	0.0
Ann	1,318	0	43,471	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	280	0	2,897	0.0	0.0
Feb	491	0	5,501	0.0	0.0
Mar	648	0	8,288	0.0	0.0
Apr	725	0	10,912	0.0	0.0
May	763	0	15,099	0.0	0.0
Jun	798	0	19,794	0.0	0.0
Jul	834	0	24,864	0.0	0.0
Aug	871	0	29,899	0.0	0.0
Sep	907	0	34,288	0.0	0.0
Oct	946	0	37,884	0.0	0.0
Nov	1,077	0	40,569	0.0	0.0
Dec	1,318	0	43,471	0.0	0.0

GERBER VILLAGE 100 AREA WITH BASEMENT
BASELINE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	862		86.17
Cooling Energy			
Direct Expansion		11,015	37.59
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,473	5.03
Equipment		1,914	6.53
System Miscellaneous			
Fans		27,968	95.46
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,318	43,471	
Unit Cost	$0.608	$0.060	
Dollar Cost	$801	$2,608	$3,409
Site Energy (MBTU)	131.8	148.4	280.2
Source Energy (MBTU)		0.0	0.0

ASEAM3 Report: Monthly Energy Consumption Date: 01-19-1995

GERBER VILLAGE 100 AREA WITH BASEMENT
INSULATE WALLS

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	186	0	2,477	0.0	0.0
Feb	141	0	2,237	0.0	0.0
Mar	109	0	2,415	0.0	0.0
Apr	54	0	2,296	0.0	0.0
May	38	0	3,648	0.0	0.0
Jun	36	0	4,086	0.0	0.0
Jul	36	0	4,409	0.0	0.0
Aug	37	0	4,380	0.0	0.0
Sep	36	0	3,822	0.0	0.0
Oct	39	0	3,140	0.0	0.0
Nov	90	0	2,335	0.0	0.0
Dec	159	0	2,490	0.0	0.0
Ann	959	0	37,735	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	186	0	2,477	0.0	0.0
Feb	326	0	4,715	0.0	0.0
Mar	435	0	7,129	0.0	0.0
Apr	489	0	9,425	0.0	0.0
May	527	0	13,073	0.0	0.0
Jun	563	0	17,159	0.0	0.0
Jul	599	0	21,569	0.0	0.0
Aug	636	0	25,948	0.0	0.0
Sep	671	0	29,770	0.0	0.0
Oct	710	0	32,910	0.0	0.0
Nov	800	0	35,245	0.0	0.0
Dec	959	0	37,735	0.0	0.0

GERBER VILLAGE 100 AREA WITH BASEMENT
INSULATE WALLS

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	503		50.28
Cooling Energy			
Direct Expansion		9,486	32.37
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,473	5.03
Equipment		1,914	6.53
System Miscellaneous			
Fans		23,762	81.10
Plant Miscellaneous			
DRYER		1,100	3.75

Consumption Totals	959	37,735	
Unit Cost	$0.608	$0.060	
Dollar Cost	$583	$2,264	$2,847
Site Energy (MBTU)	95.9	128.8	224.7
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GERBER VILLAGE 100 AREA WITH BASEMENT
INSULATE WALLS

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,318	959	359	27.2
Electricity	kWh	43,471	37,735	5,735	13.2
Gas	Dollars	801	583	218	27.2
Electricity	Dollars	2,608	2,264	344	13.2
Annual Totals	Dollars	3,409	2,847	562	16.5
Gas	MBTU	131.805	95.914	35.890	27.2
Electricity	MBTU	148.366	128.791	19.575	13.2
Annual Totals	MBTU	280.171	224.705	55.465	19.8

ASEAM3 Report: Monthly Energy Consumption Date: 01-19-1995

GV 100 AREA WITH BASEMENT
INSULATE CRAWL SPACE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	259	0	2,808	0.0	0.0
Feb	195	0	2,523	0.0	0.0
Mar	147	0	2,699	0.0	0.0
Apr	75	0	2,535	0.0	0.0
May	38	0	4,029	0.0	0.0
Jun	36	0	4,516	0.0	0.0
Jul	36	0	4,876	0.0	0.0
Aug	37	0	4,843	0.0	0.0
Sep	36	0	4,223	0.0	0.0
Oct	39	0	3,462	0.0	0.0
Nov	124	0	2,599	0.0	0.0
Dec	224	0	2,812	0.0	0.0
Ann	1,244	0	41,924	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	259	0	2,808	0.0	0.0
Feb	454	0	5,332	0.0	0.0
Mar	601	0	8,031	0.0	0.0
Apr	676	0	10,566	0.0	0.0
May	713	0	14,595	0.0	0.0
Jun	749	0	19,111	0.0	0.0
Jul	785	0	23,987	0.0	0.0
Aug	822	0	28,830	0.0	0.0
Sep	857	0	33,052	0.0	0.0
Oct	896	0	36,514	0.0	0.0
Nov	1,020	0	39,113	0.0	0.0
Dec	1,244	0	41,924	0.0	0.0

GV 100 AREA WITH BASEMENT
INSULATE CRAWL SPACE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	788		78.79
Cooling Energy			
Direct Expansion		10,566	36.06
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,473	5.03
Equipment		1,914	6.53
System Miscellaneous			
Fans		26,870	91.71
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,244	41,924	
Unit Cost	$0.608	$0.060	
Dollar Cost	$756	$2,515	$3,272
Site Energy (MBTU)	124.4	143.1	267.5
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GV 100 AREA WITH BASEMENT
INSULATE CRAWL SPACE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,318	1,244	74	5.6
Electricity	kWh	43,471	41,924	1,547	3.6
Gas	Dollars	801	756	45	5.6
Electricity	Dollars	2,608	2,515	93	3.6
Annual Totals	Dollars	3,409	3,272	138	4.0
Gas	MBTU	131.805	124.428	7.377	5.6
Electricity	MBTU	148.366	143.088	5.278	3.6
Annual Totals	MBTU	280.171	267.515	12.655	4.5

ASEAM3 Report: Monthly Energy Consumption Date: 01-09-1995

GERBER VILLAGE 100 AREA WITH BASEMENT
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	282	0	2,841	0.0	0.0
Feb	214	0	2,554	0.0	0.0
Mar	158	0	2,733	0.0	0.0
Apr	77	0	2,572	0.0	0.0
May	38	0	4,118	0.0	0.0
Jun	36	0	4,622	0.0	0.0
Jul	36	0	4,992	0.0	0.0
Aug	37	0	4,958	0.0	0.0
Sep	36	0	4,319	0.0	0.0
Oct	39	0	3,533	0.0	0.0
Nov	132	0	2,633	0.0	0.0
Dec	244	0	2,846	0.0	0.0
Ann	1,328	0	42,721	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	282	0	2,841	0.0	0.0
Feb	496	0	5,395	0.0	0.0
Mar	654	0	8,128	0.0	0.0
Apr	731	0	10,699	0.0	0.0
May	769	0	14,818	0.0	0.0
Jun	805	0	19,440	0.0	0.0
Jul	841	0	24,432	0.0	0.0
Aug	877	0	29,391	0.0	0.0
Sep	913	0	33,710	0.0	0.0
Oct	952	0	37,243	0.0	0.0
Nov	1,084	0	39,876	0.0	0.0
Dec	1,328	0	42,721	0.0	0.0

GERBER VILLAGE 100 AREA WITH BASEMENT
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	872		87.15
Cooling Energy			
Direct Expansion		10,907	37.23
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,111	3.79
Equipment		1,914	6.53
System Miscellaneous			
Fans		27,689	94.50
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,328	42,721	
Unit Cost	$0.608	$0.060	
Dollar Cost	$807	$2,563	$3,370
Site Energy (MBTU)	132.8	145.8	278.6
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GERBER VILLAGE 100 AREA WITH BASEMENT
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,318	1,328	-10	-0.7
Electricity	kWh	43,471	42,721	750	1.7
Gas	Dollars	801	807	-6	-0.7
Electricity	Dollars	2,608	2,563	45	1.7
Annual Totals	Dollars	3,409	3,370	39	1.1
Gas	MBTU	131.805	132.788	-0.983	-0.7
Electricity	MBTU	148.366	145.807	2.558	1.7
Annual Totals	MBTU	280.171	278.596	1.575	0.6

ASEAM3 Report: Monthly Energy Consumption

Date: 12-27-1994

GERBER VILLAGE 100 AREA WITH BASEMENT
REACTIVATE WHOLE HOUSE FANS/INSTALL PROGRAMMABLE T'STAT

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	238	0	2,184	0.0	0.0
Feb	181	0	1,972	0.0	0.0
Mar	130	0	2,140	0.0	0.0
Apr	59	0	2,063	0.0	0.0
May	38	0	3,654	0.0	0.0
Jun	36	0	4,196	0.0	0.0
Jul	36	0	4,562	0.0	0.0
Aug	37	0	4,524	0.0	0.0
Sep	36	0	3,885	0.0	0.0
Oct	39	0	3,051	0.0	0.0
Nov	110	0	2,074	0.0	0.0
Dec	205	0	2,195	0.0	0.0
Ann	1,145	0	36,499	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	238	0	2,184	0.0	0.0
Feb	419	0	4,156	0.0	0.0
Mar	549	0	6,296	0.0	0.0
Apr	609	0	8,358	0.0	0.0
May	646	0	12,013	0.0	0.0
Jun	682	0	16,209	0.0	0.0
Jul	718	0	20,771	0.0	0.0
Aug	755	0	25,295	0.0	0.0
Sep	790	0	29,179	0.0	0.0
Oct	829	0	32,230	0.0	0.0
Nov	940	0	34,304	0.0	0.0
Dec	1,145	0	36,499	0.0	0.0

GERBER VILLAGE 100 AREA WITH BASEMENT
REACTIVATE WHOLE HOUSE FANS/INSTALL PROGRAMMABLE T'STAT

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	689		68.87
Cooling Energy			
Direct Expansion		11,248	38.39
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,473	5.03
Equipment		1,914	6.53
System Miscellaneous			
Fans		20,764	70.87
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,145	36,499	
Unit Cost	$0.608	$0.060	
Dollar Cost	$696	$2,190	$2,886
Site Energy (MBTU)	114.5	124.6	239.1
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GERBER VILLAGE 100 AREA WITH BASEMENT
REACTIVATE WHOLE HOUSE FANS/INSTALL PROGRAMMABLE T'STAT

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,318	1,145	173	13.1
Electricity	kWh	43,471	36,499	6,972	16.0
Gas	Dollars	801	696	105	13.1
Electricity	Dollars	2,608	2,190	418	16.0
Annual Totals	Dollars	3,409	2,886	523	15.4
Gas	MBTU	131.805	114.504	17.301	13.1
Electricity	MBTU	148.366	124.572	23.794	16.0
Annual Totals	MBTU	280.171	239.076	41.095	14.7

ASEAM3 Report: Monthly Energy Consumption Date: 12-27-1994

GERBER VILLAGE 100 AREA WITH BASEMENT
MULTIPLE ECO'S

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	116	0	1,583	0.0	0.0
Feb	87	0	1,437	0.0	0.0
Mar	70	0	1,568	0.0	0.0
Apr	45	0	1,518	0.0	0.0
May	38	0	2,641	0.0	0.0
Jun	36	0	3,025	0.0	0.0
Jul	36	0	3,284	0.0	0.0
Aug	37	0	3,257	0.0	0.0
Sep	36	0	2,803	0.0	0.0
Oct	39	0	2,216	0.0	0.0
Nov	62	0	1,523	0.0	0.0
Dec	100	0	1,595	0.0	0.0
Ann	701	0	26,448	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	116	0	1,583	0.0	0.0
Feb	203	0	3,020	0.0	0.0
Mar	273	0	4,588	0.0	0.0
Apr	318	0	6,106	0.0	0.0
May	356	0	8,747	0.0	0.0
Jun	392	0	11,771	0.0	0.0
Jul	428	0	15,055	0.0	0.0
Aug	464	0	18,311	0.0	0.0
Sep	500	0	21,115	0.0	0.0
Oct	539	0	23,330	0.0	0.0
Nov	601	0	24,853	0.0	0.0
Dec	701	0	26,448	0.0	0.0

GERBER VILLAGE 100 AREA WITH BASEMENT
MULTIPLE ECO'S

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	245		24.47
Cooling Energy			
Direct Expansion		7,936	27.09
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,111	3.79
Equipment		1,914	6.53
System Miscellaneous			
Fans		14,386	49.10
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	701	26,448	
Unit Cost	$0.608	$0.060	
Dollar Cost	$426	$1,587	$2,013
Site Energy (MBTU)	70.1	90.3	160.4
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GERBER VILLAGE 100 AREA WITH BASEMENT
MULTIPLE ECO'S

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,318	701	617	46.8
Electricity	kWh	43,471	26,448	17,023	39.2
Gas	Dollars	801	426	375	46.8
Electricity	Dollars	2,608	1,587	1,021	39.2
Annual Totals	Dollars	3,409	2,013	1,396	41.0
Gas	MBTU	131.805	70.103	61.702	46.8
Electricity	MBTU	148.366	90.267	58.099	39.2
Annual Totals	MBTU	280.171	160.370	119.800	42.8

ASEAM OUTPUTS
166-171 AREA

1. BASELINE
2. INSULATE WALLS
3. INSULATE CRAWL SPACE
4. REPLACE LIGHT FIXTURES
5. INSTALL WHOLE HOUSE FANS AND PROGRAMMABLE THERMOSTATS
6. MULTIPLE ECOs

ASEAM3 Report: Monthly Energy Consumption Date: 01-19-1995

166-171 AREA TOWNHOUSES
BASELINE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	171	0	2,448	0.0	0.0
Feb	129	0	2,211	0.0	0.0
Mar	101	0	2,393	0.0	0.0
Apr	54	0	2,841	0.0	0.0
May	38	0	3,656	0.0	0.0
Jun	36	0	4,099	0.0	0.0
Jul	36	0	4,425	0.0	0.0
Aug	37	0	4,395	0.0	0.0
Sep	36	0	3,832	0.0	0.0
Oct	39	0	3,141	0.0	0.0
Nov	85	0	2,311	0.0	0.0
Dec	148	0	2,463	0.0	0.0
Ann	907	0	38,214	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	171	0	2,448	0.0	0.0
Feb	300	0	4,660	0.0	0.0
Mar	400	0	7,053	0.0	0.0
Apr	454	0	9,894	0.0	0.0
May	492	0	13,550	0.0	0.0
Jun	528	0	17,648	0.0	0.0
Jul	564	0	22,073	0.0	0.0
Aug	600	0	26,468	0.0	0.0
Sep	636	0	30,300	0.0	0.0
Oct	675	0	33,440	0.0	0.0
Nov	760	0	35,751	0.0	0.0
Dec	907	0	38,214	0.0	0.0

166-171 AREA TOWNHOUSES
BASELINE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	451		45.09
Cooling Energy			
Direct Expansion		10,153	34.65
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,008	3.44
Equipment		1,946	6.64
System Miscellaneous			
Fans		24,008	81.94
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	907	38,214	
Unit Cost	$0.608	$0.060	
Dollar Cost	$552	$2,293	$2,844
Site Energy (MBTU)	90.7	130.4	221.2
Source Energy (MBTU)		0.0	0.0

ASEAM3 Report: Monthly Energy Consumption   Date: 01-19-1995

166-171 AREA TOWNHOUSES
INSULATE WALLS

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	120	0	2,161	0.0	0.0
Feb	91	0	1,955	0.0	0.0
Mar	71	0	2,124	0.0	0.0
Apr	46	0	2,531	0.0	0.0
May	38	0	3,252	0.0	0.0
Jun	36	0	3,641	0.0	0.0
Jul	36	0	3,929	0.0	0.0
Aug	37	0	3,903	0.0	0.0
Sep	36	0	3,406	0.0	0.0
Oct	39	0	2,798	0.0	0.0
Nov	61	0	2,057	0.0	0.0
Dec	102	0	2,177	0.0	0.0
Ann	713	0	33,935	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	120	0	2,161	0.0	0.0
Feb	211	0	4,117	0.0	0.0
Mar	283	0	6,241	0.0	0.0
Apr	329	0	8,772	0.0	0.0
May	367	0	12,023	0.0	0.0
Jun	402	0	15,665	0.0	0.0
Jul	439	0	19,594	0.0	0.0
Aug	475	0	23,497	0.0	0.0
Sep	511	0	26,903	0.0	0.0
Oct	550	0	29,701	0.0	0.0
Nov	611	0	31,758	0.0	0.0
Dec	713	0	33,935	0.0	0.0

166-171 AREA TOWNHOUSES
INSULATE WALLS

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	257		25.70
Cooling Energy			
Direct Expansion		8,938	30.51
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,008	3.44
Equipment		1,946	6.64
System Miscellaneous			
Fans		20,943	71.48
Plant Miscellaneous			
DRYER		1,100	3.75

Consumption Totals	713	33,935	
Unit Cost	$0.608	$0.060	
Dollar Cost	$434	$2,036	$2,470
Site Energy (MBTU)	71.3	115.8	187.2
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

166-171 AREA TOWNHOUSES
INSULATE WALLS

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	907	713	194	21.4
Electricity	kWh	38,214	33,935	4,279	11.2
Gas	Dollars	552	434	118	21.4
Electricity	Dollars	2,293	2,036	257	11.2
Annual Totals	Dollars	2,844	2,470	375	13.2
Gas	MBTU	90.731	71.333	19.398	21.4
Electricity	MBTU	130.425	115.820	14.605	11.2
Annual Totals	MBTU	221.156	187.153	34.003	15.4

ASEAM3 Report: Monthly Energy Consumption Date: 01-19-1995

166-171 AREA TOWNHOUSE
INSULATE CRAWL SPACE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	151	0	2,346	0.0	0.0
Feb	113	0	2,119	0.0	0.0
Mar	90	0	2,294	0.0	0.0
Apr	51	0	2,720	0.0	0.0
May	38	0	3,496	0.0	0.0
Jun	36	0	3,918	0.0	0.0
Jul	36	0	4,229	0.0	0.0
Aug	37	0	4,200	0.0	0.0
Sep	36	0	3,664	0.0	0.0
Oct	39	0	3,005	0.0	0.0
Nov	77	0	2,215	0.0	0.0
Dec	131	0	2,360	0.0	0.0
Ann	835	0	36,565	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	151	0	2,346	0.0	0.0
Feb	264	0	4,465	0.0	0.0
Mar	355	0	6,758	0.0	0.0
Apr	406	0	9,478	0.0	0.0
May	444	0	12,974	0.0	0.0
Jun	479	0	16,892	0.0	0.0
Jul	516	0	21,121	0.0	0.0
Aug	552	0	25,321	0.0	0.0
Sep	588	0	28,985	0.0	0.0
Oct	627	0	31,991	0.0	0.0
Nov	704	0	34,206	0.0	0.0
Dec	835	0	36,565	0.0	0.0

166-171 AREA TOWNHOUSE
INSULATE CRAWL SPACE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	379		37.89
Cooling Energy			
Direct Expansion		9,673	33.01
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,008	3.44
Equipment		1,946	6.64
System Miscellaneous			
Fans		22,839	77.95
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	835	36,565	
Unit Cost	$0.608	$0.060	
Dollar Cost	$508	$2,194	$2,702
Site Energy (MBTU)	83.5	124.8	208.3
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

166-171 AREA TOWNHOUSE
INSULATE CRAWL SPACE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	907	835	72	7.9
Electricity	kWh	38,214	36,565	1,649	4.3
Gas	Dollars	552	508	44	7.9
Electricity	Dollars	2,293	2,194	99	4.3
Annual Totals	Dollars	2,844	2,702	143	5.0
Gas	MBTU	90.731	83.530	7.202	7.9
Electricity	MBTU	130.425	124.797	5.628	4.3
Annual Totals	MBTU	221.156	208.327	12.830	5.8

ASEAM3 Report: Monthly Energy Consumption Date: 01-19-1995

166-171 AREA TOWNHOUSE
REPLACEMENT 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	173	0	2,401	0.0	0.0
Feb	130	0	2,169	0.0	0.0
Mar	101	0	2,347	0.0	0.0
Apr	54	0	2,790	0.0	0.0
May	38	0	3,595	0.0	0.0
Jun	36	0	4,034	0.0	0.0
Jul	36	0	4,356	0.0	0.0
Aug	37	0	4,326	0.0	0.0
Sep	36	0	3,770	0.0	0.0
Oct	39	0	3,086	0.0	0.0
Nov	86	0	2,266	0.0	0.0
Dec	149	0	2,415	0.0	0.0
Ann	915	0	37,553	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	173	0	2,401	0.0	0.0
Feb	303	0	4,569	0.0	0.0
Mar	405	0	6,916	0.0	0.0
Apr	459	0	9,706	0.0	0.0
May	496	0	13,301	0.0	0.0
Jun	532	0	17,335	0.0	0.0
Jul	568	0	21,690	0.0	0.0
Aug	605	0	26,016	0.0	0.0
Sep	641	0	29,787	0.0	0.0
Oct	680	0	32,872	0.0	0.0
Nov	765	0	35,138	0.0	0.0
Dec	915	0	37,553	0.0	0.0

166-171 AREA TOWNHOUSE
REPLACEMENT 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	458		45.82
Cooling Energy			
Direct Expansion		10,043	34.28
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		724	2.47
Equipment		1,946	6.64
System Miscellaneous			
Fans		23,741	81.03
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	915	37,553	
Unit Cost	$0.608	$0.060	
Dollar Cost	$556	$2,253	$2,809
Site Energy (MBTU)	91.5	128.2	219.6
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

166-171 AREA TOWNHOUSE
REPLACEMENT 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	907	915	-7	-0.8
Electricity	kWh	38,214	37,553	661	1.7
Gas	Dollars	552	556	-4	-0.8
Electricity	Dollars	2,293	2,253	40	1.7
Annual Totals	Dollars	2,844	2,809	35	1.2
Gas	MBTU	90.731	91.461	-0.730	-0.8
Electricity	MBTU	130.425	128.169	2.256	1.7
Annual Totals	MBTU	221.156	219.630	1.526	0.7

ASEAM3 Report: Monthly Energy Consumption Date: 01-19-1995

166-171 AREA TOWNHOUSE
INSTALL NEW WHOLE HOUSE FAN/PROGRAMMABLE THERMOSTAT

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	156	0	1,875	0.0	0.0
Feb	118	0	1,703	0.0	0.0
Mar	87	0	1,865	0.0	0.0
Apr	51	0	2,241	0.0	0.0
May	38	0	3,194	0.0	0.0
Jun	36	0	3,667	0.0	0.0
Jul	36	0	3,986	0.0	0.0
Aug	37	0	3,952	0.0	0.0
Sep	36	0	3,395	0.0	0.0
Oct	39	0	2,668	0.0	0.0
Nov	78	0	1,810	0.0	0.0
Dec	135	0	1,892	0.0	0.0
Ann	845	0	32,248	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	156	0	1,875	0.0	0.0
Feb	274	0	3,578	0.0	0.0
Mar	361	0	5,443	0.0	0.0
Apr	412	0	7,684	0.0	0.0
May	450	0	10,878	0.0	0.0
Jun	485	0	14,545	0.0	0.0
Jul	521	0	18,531	0.0	0.0
Aug	558	0	22,483	0.0	0.0
Sep	594	0	25,878	0.0	0.0
Oct	633	0	28,546	0.0	0.0
Nov	711	0	30,357	0.0	0.0
Dec	845	0	32,248	0.0	0.0

166-171 AREA TOWNHOUSE
INSTALL NEW WHOLE HOUSE FAN/PROGRAMMABLE THERMOSTAT

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	389		38.88
Cooling Energy			
Direct Expansion		10,240	34.95
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,008	3.44
Equipment		1,946	6.64
System Miscellaneous			
Fans		17,955	61.28
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	845	32,248	
Unit Cost	$0.608	$0.060	
Dollar Cost	$514	$1,935	$2,449
Site Energy (MBTU)	84.5	110.1	194.6
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

166-171 AREA TOWNHOUSE
INSTALL NEW WHOLE HOUSE FAN/PROGRAMMABLE THERMOSTAT

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	907	845	62	6.8
Electricity	kWh	38,214	32,248	5,966	15.6
Gas	Dollars	552	514	38	6.8
Electricity	Dollars	2,293	1,935	358	15.6
Annual Totals	Dollars	2,844	2,449	396	13.9
Gas	MBTU	90.731	84.523	6.208	6.8
Electricity	MBTU	130.425	110.063	20.362	15.6
Annual Totals	MBTU	221.156	194.586	26.570	12.0

166-171 AREA
MULTIPLE ECO'S

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	102	0	1,549	0.0	0.0
Feb	76	0	1,410	0.0	0.0
Mar	61	0	1,548	0.0	0.0
Apr	42	0	1,854	0.0	0.0
May	38	0	2,634	0.0	0.0
Jun	36	0	3,020	0.0	0.0
Jul	36	0	3,281	0.0	0.0
Aug	37	0	3,253	0.0	0.0
Sep	36	0	2,798	0.0	0.0
Oct	39	0	2,205	0.0	0.0
Nov	55	0	1,504	0.0	0.0
Dec	88	0	1,564	0.0	0.0
Ann	644	0	26,620	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	102	0	1,549	0.0	0.0
Feb	178	0	2,959	0.0	0.0
Mar	239	0	4,507	0.0	0.0
Apr	280	0	6,361	0.0	0.0
May	318	0	8,995	0.0	0.0
Jun	354	0	12,015	0.0	0.0
Jul	390	0	15,296	0.0	0.0
Aug	427	0	18,549	0.0	0.0
Sep	462	0	21,347	0.0	0.0
Oct	501	0	23,552	0.0	0.0
Nov	556	0	25,056	0.0	0.0
Dec	644	0	26,620	0.0	0.0

166-171 AREA
MULTIPLE ECO'S

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	188		18.78
Cooling Energy			
Direct Expansion		8,350	28.50
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		724	2.47
Equipment		1,946	6.64
System Miscellaneous			
Fans		14,500	49.49
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	644	26,620	
Unit Cost	$0.608	$0.060	
Dollar Cost	$392	$1,597	$1,989
Site Energy (MBTU)	64.4	90.9	155.3
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

166-171 AREA
MULTIPLE ECO'S

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	907	644	263	29.0
Electricity	kWh	38,214	26,620	11,595	30.3
Gas	Dollars	552	392	160	29.0
Electricity	Dollars	2,293	1,597	696	30.3
Annual Totals	Dollars	2,844	1,989	856	30.1
Gas	MBTU	90.731	64.417	26.314	29.0
Electricity	MBTU	130.425	90.853	39.573	30.3
Annual Totals	MBTU	221.156	155.270	65.887	29.8

ASEAM OUTPUTS
400 AREA - T SHAPE

1. BASELINE

2. INSULATE WALLS

3. REPLACE LIGHT FIXTURES

4. INSTALL WHOLE HOUSE FANS AND PROGRAMMABLE THERMOSTATS

5. INSULATE DOMESTIC WATER HEATERS IN CRAWL SPACE

6. MULTIPLE ECOs

ASEAM3 Report: Monthly Energy Consumption

Date: 01-10-1995

400 AREA "T"-SHAPE HOUSES
BASELINE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	203	0	2,141	0.0	0.0
Feb	157	0	1,939	0.0	0.0
Mar	119	0	2,098	0.0	0.0
Apr	60	0	1,995	0.0	0.0
May	38	0	3,145	0.0	0.0
Jun	36	0	3,519	0.0	0.0
Jul	36	0	3,795	0.0	0.0
Aug	37	0	3,770	0.0	0.0
Sep	36	0	3,294	0.0	0.0
Oct	39	0	2,712	0.0	0.0
Nov	101	0	2,027	0.0	0.0
Dec	177	0	2,152	0.0	0.0
Ann	1,039	0	32,587	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	203	0	2,141	0.0	0.0
Feb	360	0	4,080	0.0	0.0
Mar	479	0	6,179	0.0	0.0
Apr	539	0	8,174	0.0	0.0
May	577	0	11,319	0.0	0.0
Jun	613	0	14,838	0.0	0.0
Jul	649	0	18,633	0.0	0.0
Aug	685	0	22,402	0.0	0.0
Sep	721	0	25,696	0.0	0.0
Oct	760	0	28,408	0.0	0.0
Nov	861	0	30,435	0.0	0.0
Dec	1,039	0	32,587	0.0	0.0

400 AREA "T"-SHAPE HOUSES
BASELINE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	583		58.25
Cooling Energy			
Direct Expansion		8,081	27.58
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,116	3.81
Equipment		1,914	6.53
System Miscellaneous			
Fans		20,376	69.54
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,039	32,587	
Unit Cost	$0.608	$0.060	
Dollar Cost	$632	$1,955	$2,587
Site Energy (MBTU)	103.9	111.2	215.1
Source Energy (MBTU)		0.0	0.0

ASEAM3 Report: Monthly Energy Consumption Date: 12-28-1994

400 AREA "T"-SHAPE HOUSES
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	206	0	2,076	0.0	0.0
Feb	160	0	1,880	0.0	0.0
Mar	121	0	2,033	0.0	0.0
Apr	61	0	1,931	0.0	0.0
May	38	0	3,059	0.0	0.0
Jun	36	0	3,426	0.0	0.0
Jul	36	0	3,697	0.0	0.0
Aug	37	0	3,672	0.0	0.0
Sep	36	0	3,206	0.0	0.0
Oct	39	0	2,634	0.0	0.0
Nov	103	0	1,963	0.0	0.0
Dec	180	0	2,086	0.0	0.0
Ann	1,052	0	31,663	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	206	0	2,076	0.0	0.0
Feb	366	0	3,956	0.0	0.0
Mar	487	0	5,989	0.0	0.0
Apr	548	0	7,920	0.0	0.0
May	586	0	10,979	0.0	0.0
Jun	622	0	14,405	0.0	0.0
Jul	658	0	18,102	0.0	0.0
Aug	695	0	21,774	0.0	0.0
Sep	730	0	24,980	0.0	0.0
Oct	769	0	27,614	0.0	0.0
Nov	872	0	29,577	0.0	0.0
Dec	1,052	0	31,663	0.0	0.0

400 AREA "T"-SHAPE HOUSES
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	596		59.61
Cooling Energy			
Direct Expansion		7,932	27.07
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		716	2.44
Equipment		1,914	6.53
System Miscellaneous			
Fans		20,001	68.26
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,052	31,663	
Unit Cost	$0.608	$0.060	
Dollar Cost	$640	$1,900	$2,540
Site Energy (MBTU)	105.2	108.1	213.3
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

400 AREA "T"-SHAPE HOUSES
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,039	1,052	-14	-1.3
Electricity	kWh	32,587	31,663	924	2.8
Gas	Dollars	632	640	-8	-1.3
Electricity	Dollars	1,955	1,900	55	2.8
Annual Totals	Dollars	2,587	2,540	47	1.8
Gas	MBTU	103.891	105.245	-1.355	-1.3
Electricity	MBTU	111.220	108.066	3.154	2.8
Annual Totals	MBTU	215.110	213.311	1.799	0.8

ASEAM3 Report: Monthly Energy Consumption Date: 12-28-1994

400 AREA 'T'-SHAPE HOUSES
INSTALL PROGRAMMABLE THERMOSTATS/NEW WHOLE HOUSE FANS

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	187	0	1,633	0.0	0.0
Feb	142	0	1,484	0.0	0.0
Mar	106	0	1,620	0.0	0.0
Apr	55	0	1,567	0.0	0.0
May	38	0	2,720	0.0	0.0
Jun	36	0	3,111	0.0	0.0
Jul	36	0	3,377	0.0	0.0
Aug	37	0	3,349	0.0	0.0
Sep	36	0	2,885	0.0	0.0
Oct	39	0	2,284	0.0	0.0
Nov	96	0	1,572	0.0	0.0
Dec	163	0	1,646	0.0	0.0
Ann	971	0	27,250	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	187	0	1,633	0.0	0.0
Feb	330	0	3,117	0.0	0.0
Mar	436	0	4,738	0.0	0.0
Apr	491	0	6,305	0.0	0.0
May	529	0	9,026	0.0	0.0
Jun	564	0	12,136	0.0	0.0
Jul	600	0	15,513	0.0	0.0
Aug	637	0	18,862	0.0	0.0
Sep	673	0	21,748	0.0	0.0
Oct	712	0	24,032	0.0	0.0
Nov	807	0	25,604	0.0	0.0
Dec	971	0	27,250	0.0	0.0

400 AREA 'T'-SHAPE HOUSES
INSTALL PROGRAMMABLE THERMOSTATS/NEW WHOLE HOUSE FANS

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	514		51.41
Cooling Energy			
Direct Expansion		8,136	27.77
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,116	3.81
Equipment		1,914	6.53
System Miscellaneous			
Fans		14,984	51.14
Plant Miscellaneous			
DRYER		1,100	3.75

Consumption Totals	971	27,250	
Unit Cost	$0.608	$0.060	
Dollar Cost	$590	$1,635	$2,225
Site Energy (MBTU)	97.1	93.0	190.1
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

400 AREA 'T'-SHAPE HOUSES
INSTALL PROGRAMMABLE THERMOSTATS/NEW WHOLE HOUSE FANS

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,039	971	68	6.6
Electricity	kWh	32,587	27,250	5,337	16.4
Gas	Dollars	632	590	42	6.6
Electricity	Dollars	1,955	1,635	320	16.4
Annual Totals	Dollars	2,587	2,225	362	14.0
Gas	MBTU	103.891	97.052	6.839	6.6
Electricity	MBTU	111.220	93.004	18.216	16.4
Annual Totals	MBTU	215.110	190.056	25.055	11.6

ASEAM3 Report: Monthly Energy Consumption Date: 12-28-1994

400 AREA "T"-SHAPE HOUSES
INSULATE DOMESTIC WATER HEATERS IN CRAWL SPACE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	201	0	2,141	0.0	0.0
Feb	154	0	1,939	0.0	0.0
Mar	116	0	2,098	0.0	0.0
Apr	58	0	1,995	0.0	0.0
May	35	0	3,145	0.0	0.0
Jun	33	0	3,519	0.0	0.0
Jul	34	0	3,795	0.0	0.0
Aug	34	0	3,770	0.0	0.0
Sep	33	0	3,294	0.0	0.0
Oct	36	0	2,712	0.0	0.0
Nov	99	0	2,027	0.0	0.0
Dec	175	0	2,152	0.0	0.0
Ann	1,009	0	32,587	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	201	0	2,141	0.0	0.0
Feb	355	0	4,080	0.0	0.0
Mar	471	0	6,179	0.0	0.0
Apr	529	0	8,174	0.0	0.0
May	564	0	11,319	0.0	0.0
Jun	597	0	14,838	0.0	0.0
Jul	631	0	18,633	0.0	0.0
Aug	665	0	22,402	0.0	0.0
Sep	699	0	25,696	0.0	0.0
Oct	735	0	28,408	0.0	0.0
Nov	834	0	30,435	0.0	0.0
Dec	1,009	0	32,587	0.0	0.0

400 AREA "T"-SHAPE HOUSES
INSULATE DOMESTIC WATER HEATERS IN CRAWL SPACE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	583		58.25
Cooling Energy			
Direct Expansion		8,081	27.58
Domestic Hot Water Energy			
Domestic HW Heater	426		42.60
Building Miscellaneous			
Lights		1,116	3.81
Equipment		1,914	6.53
System Miscellaneous			
Fans		20,376	69.54
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,009	32,587	
Unit Cost	$0.608	$0.060	
Dollar Cost	$613	$1,955	$2,568
Site Energy (MBTU)	100.9	111.2	212.1
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

400 AREA "T"-SHAPE HOUSES
INSULATE DOMESTIC WATER HEATERS IN CRAWL SPACE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,039	1,009	30	2.9
Electricity	kWh	32,587	32,587	0	0.0
Gas	Dollars	632	613	18	2.9
Electricity	Dollars	1,955	1,955	0	0.0
Annual Totals	Dollars	2,587	2,568	18	0.7
Gas	MBTU	103.891	100.855	3.036	2.9
Electricity	MBTU	111.220	111.220	0.000	0.0
Annual Totals	MBTU	215.110	212.075	3.036	1.4

ASEAM3 Report: Monthly Energy Consumption Date: 01-10-1995

400 AREA "T"-SHAPE HOUSES
MULTIPLE ECO'S

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	187	0	1,576	0.0	0.0
Feb	142	0	1,432	0.0	0.0
Mar	105	0	1,563	0.0	0.0
Apr	53	0	1,511	0.0	0.0
May	35	0	2,642	0.0	0.0
Jun	33	0	3,026	0.0	0.0
Jul	34	0	3,286	0.0	0.0
Aug	34	0	3,259	0.0	0.0
Sep	33	0	2,805	0.0	0.0
Oct	36	0	2,213	0.0	0.0
Nov	95	0	1,516	0.0	0.0
Dec	163	0	1,588	0.0	0.0
Ann	951	0	26,418	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	187	0	1,576	0.0	0.0
Feb	329	0	3,008	0.0	0.0
Mar	434	0	4,570	0.0	0.0
Apr	487	0	6,082	0.0	0.0
May	523	0	8,723	0.0	0.0
Jun	556	0	11,750	0.0	0.0
Jul	590	0	15,036	0.0	0.0
Aug	624	0	18,295	0.0	0.0
Sep	658	0	21,100	0.0	0.0
Oct	694	0	23,314	0.0	0.0
Nov	788	0	24,830	0.0	0.0
Dec	951	0	26,418	0.0	0.0

400 AREA "T"-SHAPE HOUSES
MULTIPLE ECO'S

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	525		52.52
Cooling Energy			
Direct Expansion		7,986	27.26
Domestic Hot Water Energy			
Domestic HW Heater	426		42.60
Building Miscellaneous			
Lights		716	2.44
Equipment		1,914	6.53
System Miscellaneous			
Fans		14,702	50.18
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	951	26,418	
Unit Cost	$0.608	$0.060	
Dollar Cost	$578	$1,585	$2,163
Site Energy (MBTU)	95.1	90.2	185.3
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

400 AREA "T"-SHAPE HOUSES
MULTIPLE ECO'S

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,039	951	88	8.4
Electricity	kWh	32,587	26,418	6,169	18.9
Gas	Dollars	632	578	53	8.4
Electricity	Dollars	1,955	1,585	370	18.9
Annual Totals	Dollars	2,587	2,163	423	16.4
Gas	MBTU	103.891	95.123	8.768	8.4
Electricity	MBTU	111.220	90.164	21.056	18.9
Annual Totals	MBTU	215.110	185.286	29.824	13.9

ASEAM OUTPUTS
400 AREA - L SHAPE

1. BASELINE

2. INSULATE EXTERIOR WALLS

3. INSULATE CRAWL SPACE

4. REPLACE LIGHT FIXTURES

5. INSTALL WHOLE HOUSE FANS AND PROGRAMMABLE THERMOSTATS

6. MULTIPLE ECOs

ASEAM3 Report: Monthly Energy Consumption

Date: 12-28-1994

400 AREA "L"-SHAPE HOUSES
BASELINE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	244	0	2,241	0.0	0.0
Feb	192	0	2,028	0.0	0.0
Mar	145	0	2,189	0.0	0.0
Apr	68	0	2,070	0.0	0.0
May	38	0	3,262	0.0	0.0
Jun	36	0	3,650	0.0	0.0
Jul	36	0	3,937	0.0	0.0
Aug	37	0	3,911	0.0	0.0
Sep	36	0	3,416	0.0	0.0
Oct	39	0	2,810	0.0	0.0
Nov	118	0	2,106	0.0	0.0
Dec	211	0	2,248	0.0	0.0
Ann	1,200	0	33,868	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	244	0	2,241	0.0	0.0
Feb	436	0	4,269	0.0	0.0
Mar	581	0	6,458	0.0	0.0
Apr	649	0	8,528	0.0	0.0
May	687	0	11,790	0.0	0.0
Jun	723	0	15,440	0.0	0.0
Jul	759	0	19,377	0.0	0.0
Aug	796	0	23,289	0.0	0.0
Sep	832	0	26,704	0.0	0.0
Oct	870	0	29,515	0.0	0.0
Nov	988	0	31,620	0.0	0.0
Dec	1,200	0	33,868	0.0	0.0

400 AREA "L"-SHAPE HOUSES
BASELINE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	743		74.32
Cooling Energy			
Direct Expansion		8,422	28.74
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,252	4.27
Equipment		1,914	6.53
System Miscellaneous			
Fans		21,180	72.29
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,200	33,868	
Unit Cost	$0.608	$0.060	
Dollar Cost	$729	$2,032	$2,761
Site Energy (MBTU)	120.0	115.6	235.5
Source Energy (MBTU)		0.0	0.0

ASEAM3 Report: Monthly Energy Consumption Date: 01-19-1995

400 AREA L SHAPE HOUSE
INSULATE CRAWL SPACE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	159	0	1,910	0.0	0.0
Feb	122	0	1,731	0.0	0.0
Mar	95	0	1,877	0.0	0.0
Apr	47	0	1,791	0.0	0.0
May	38	0	2,811	0.0	0.0
Jun	36	0	3,139	0.0	0.0
Jul	36	0	3,384	0.0	0.0
Aug	37	0	3,362	0.0	0.0
Sep	36	0	2,940	0.0	0.0
Oct	39	0	2,428	0.0	0.0
Nov	79	0	1,815	0.0	0.0
Dec	136	0	1,920	0.0	0.0
Ann	859	0	29,108	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	159	0	1,910	0.0	0.0
Feb	281	0	3,641	0.0	0.0
Mar	376	0	5,519	0.0	0.0
Apr	423	0	7,310	0.0	0.0
May	461	0	10,120	0.0	0.0
Jun	497	0	13,260	0.0	0.0
Jul	533	0	16,644	0.0	0.0
Aug	570	0	20,005	0.0	0.0
Sep	606	0	22,946	0.0	0.0
Oct	644	0	25,373	0.0	0.0
Nov	723	0	27,188	0.0	0.0
Dec	859	0	29,108	0.0	0.0

400 AREA L SHAPE HOUSE
INSULATE CRAWL SPACE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	403		40.30
Cooling Energy			
Direct Expansion		7,140	24.37
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,252	4.27
Equipment		1,914	6.53
System Miscellaneous			
Fans		17,702	60.42
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	859	29,108	
Unit Cost	$0.608	$0.060	
Dollar Cost	$522	$1,746	$2,269
Site Energy (MBTU)	85.9	99.3	185.3
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

400 AREA L SHAPE HOUSE
INSULATE CRAWL SPACE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,200	859	340	28.4
Electricity	kWh	33,868	29,108	4,760	14.1
Gas	Dollars	729	522	207	28.4
Electricity	Dollars	2,032	1,746	286	14.1
Annual Totals	Dollars	2,761	2,269	492	17.8
Gas	MBTU	119.953	85.943	34.010	28.4
Electricity	MBTU	115.592	99.346	16.246	14.1
Annual Totals	MBTU	235.545	185.288	50.257	21.3

ASEAM3 Report: Monthly Energy Consumption

Date: 12-28-1994

400 AREA "L"-SHAPE HOUSES
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	247	0	2,176	0.0	0.0
Feb	194	0	1,969	0.0	0.0
Mar	151	0	2,123	0.0	0.0
Apr	69	0	2,006	0.0	0.0
May	38	0	3,176	0.0	0.0
Jun	36	0	3,558	0.0	0.0
Jul	36	0	3,839	0.0	0.0
Aug	37	0	3,813	0.0	0.0
Sep	36	0	3,328	0.0	0.0
Oct	39	0	2,732	0.0	0.0
Nov	120	0	2,042	0.0	0.0
Dec	214	0	2,182	0.0	0.0
Ann	1,216	0	32,944	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	247	0	2,176	0.0	0.0
Feb	441	0	4,145	0.0	0.0
Mar	593	0	6,268	0.0	0.0
Apr	662	0	8,274	0.0	0.0
May	700	0	11,450	0.0	0.0
Jun	735	0	15,008	0.0	0.0
Jul	771	0	18,847	0.0	0.0
Aug	808	0	22,660	0.0	0.0
Sep	844	0	25,988	0.0	0.0
Oct	883	0	28,720	0.0	0.0
Nov	1,002	0	30,762	0.0	0.0
Dec	1,216	0	32,944	0.0	0.0

400 AREA "L"-SHAPE HOUSES
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	760		76.00
Cooling Energy			
Direct Expansion		8,273	28.24
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		851	2.91
Equipment		1,914	6.53
System Miscellaneous			
Fans		20,805	71.01
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,216	32,944	
Unit Cost	$0.608	$0.060	
Dollar Cost	$739	$1,977	$2,716
Site Energy (MBTU)	121.6	112.4	234.1
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

400 AREA "L"-SHAPE HOUSES
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,200	1,216	-17	-1.4
Electricity	kWh	33,868	32,944	924	2.7
Gas	Dollars	729	739	-10	-1.4
Electricity	Dollars	2,032	1,977	55	2.7
Annual Totals	Dollars	2,761	2,716	45	1.6
Gas	MBTU	119.953	121.634	-1.681	-1.4
Electricity	MBTU	115.592	112.438	3.154	2.7
Annual Totals	MBTU	235.545	234.072	1.473	0.6

ASEAM3 Report: Monthly Energy Consumption Date: 12-28-1994

400 AREA 'L'-SHAPE HOUSES
INSTALL PROGRAMMABLE THERMOSTATS/NEW WHOLE HOUSE FANS

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	198	0	1,831	0.0	0.0
Feb	153	0	1,666	0.0	0.0
Mar	117	0	1,825	0.0	0.0
Apr	58	0	1,768	0.0	0.0
May	38	0	3,104	0.0	0.0
Jun	36	0	3,558	0.0	0.0
Jul	36	0	3,866	0.0	0.0
Aug	37	0	3,834	0.0	0.0
Sep	36	0	3,297	0.0	0.0
Oct	39	0	2,598	0.0	0.0
Nov	91	0	1,771	0.0	0.0
Dec	168	0	1,846	0.0	0.0
Ann	1,005	0	30,964	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	198	0	1,831	0.0	0.0
Feb	351	0	3,497	0.0	0.0
Mar	467	0	5,322	0.0	0.0
Apr	525	0	7,090	0.0	0.0
May	563	0	10,195	0.0	0.0
Jun	599	0	13,753	0.0	0.0
Jul	635	0	17,619	0.0	0.0
Aug	671	0	21,452	0.0	0.0
Sep	707	0	24,749	0.0	0.0
Oct	746	0	27,347	0.0	0.0
Nov	837	0	29,118	0.0	0.0
Dec	1,005	0	30,964	0.0	0.0

400 AREA 'L'-SHAPE HOUSES
INSTALL PROGRAMMABLE THERMOSTATS/NEW WHOLE HOUSE FANS

* Building Annual Energy by * * End Use and Fuel Type *	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	549		54.85
Cooling Energy			
Direct Expansion		9,435	32.20
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,252	4.27
Equipment		1,914	6.53
System Miscellaneous			
Fans		17,263	58.92
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,005	30,964	
Unit Cost	$0.608	$0.060	
Dollar Cost	$611	$1,858	$2,469
Site Energy (MBTU)	100.5	105.7	206.2
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

400 AREA 'L'-SHAPE HOUSES
INSTALL PROGRAMMABLE THERMOSTATS/NEW WHOLE HOUSE FANS

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,200	1,005	195	16.2
Electricity	kWh	33,868	30,964	2,904	8.6
Gas	Dollars	729	611	118	16.2
Electricity	Dollars	2,032	1,858	174	8.6
Annual Totals	Dollars	2,761	2,469	293	10.6
Gas	MBTU	119.953	100.492	19.461	16.2
Electricity	MBTU	115.592	105.681	9.911	8.6
Annual Totals	MBTU	235.545	206.173	29.372	12.5

ASEAM3 Report: Monthly Energy Consumption Date: 12-28-1994

400 AREA "L"-SHAPE HOUSES
MULTIPLE ECO'S

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	127	0	1,330	0.0	0.0
Feb	97	0	1,212	0.0	0.0
Mar	76	0	1,325	0.0	0.0
Apr	41	0	1,284	0.0	0.0
May	35	0	2,209	0.0	0.0
Jun	33	0	2,524	0.0	0.0
Jul	34	0	2,738	0.0	0.0
Aug	34	0	2,716	0.0	0.0
Sep	33	0	2,342	0.0	0.0
Oct	36	0	1,859	0.0	0.0
Nov	63	0	1,287	0.0	0.0
Dec	109	0	1,340	0.0	0.0
Ann	719	0	22,166	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	127	0	1,330	0.0	0.0
Feb	224	0	2,541	0.0	0.0
Mar	300	0	3,866	0.0	0.0
Apr	341	0	5,150	0.0	0.0
May	377	0	7,359	0.0	0.0
Jun	410	0	9,884	0.0	0.0
Jul	444	0	12,622	0.0	0.0
Aug	478	0	15,338	0.0	0.0
Sep	511	0	17,680	0.0	0.0
Oct	548	0	19,539	0.0	0.0
Nov	610	0	20,826	0.0	0.0
Dec	719	0	22,166	0.0	0.0

400 AREA "L"-SHAPE HOUSES
MULTIPLE ECO'S

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	293		29.33
Cooling Energy			
Direct Expansion		6,533	22.30
Domestic Hot Water Energy			
Domestic HW Heater	426		42.60
Building Miscellaneous			
Lights		851	2.91
Equipment		1,914	6.53
System Miscellaneous			
Fans		11,768	40.16
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	719	22,166	
Unit Cost	$0.608	$0.060	
Dollar Cost	$437	$1,330	$1,767
Site Energy (MBTU)	71.9	75.7	147.6
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

400 AREA "L"-SHAPE HOUSES
MULTIPLE ECO'S

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,200	719	480	40.0
Electricity	kWh	33,868	22,166	11,702	34.6
Gas	Dollars	729	437	292	40.0
Electricity	Dollars	2,032	1,330	702	34.6
Annual Totals	Dollars	2,761	1,767	994	36.0
Gas	MBTU	119.953	71.935	48.018	40.0
Electricity	MBTU	115.592	75.653	39.939	34.6
Annual Totals	MBTU	235.545	147.589	87.956	37.3

ASEAM OUTPUTS
RV 1600 AREA

1. BASELINE

2. INSTALL WHOLE HOUSEFANS AND PROGRAMMABLE THERMOSTATS

3. REPLACE LIGHT FIXTURES

4. MULTIPLE ECOs

RIVER VILLAGE 1600 AREA
INSTALL PROGRAMMABLE THERMOSTATS/NEW WHOLE HOUSE FANS

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	78	0	1,241	0.0	0.0
Feb	60	0	1,130	0.0	0.0
Mar	52	0	1,238	0.0	0.0
Apr	39	0	1,457	0.0	0.0
May	38	0	2,039	0.0	0.0
Jun	36	0	2,326	0.0	0.0
Jul	36	0	2,521	0.0	0.0
Aug	37	0	2,500	0.0	0.0
Sep	36	0	2,160	0.0	0.0
Oct	39	0	1,723	0.0	0.0
Nov	48	0	1,203	0.0	0.0
Dec	68	0	1,252	0.0	0.0
Ann	565	0	20,791	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	78	0	1,241	0.0	0.0
Feb	138	0	2,372	0.0	0.0
Mar	190	0	3,610	0.0	0.0
Apr	229	0	5,066	0.0	0.0
May	267	0	7,106	0.0	0.0
Jun	302	0	9,432	0.0	0.0
Jul	338	0	11,952	0.0	0.0
Aug	375	0	14,453	0.0	0.0
Sep	411	0	16,613	0.0	0.0
Oct	450	0	18,335	0.0	0.0
Nov	497	0	19,539	0.0	0.0
Dec	565	0	20,791	0.0	0.0

RIVER VILLAGE 1600 AREA
INSTALL PROGRAMMABLE THERMOSTATS/NEW WHOLE HOUSE FANS

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	109		10.85
Cooling Energy			
Direct Expansion		6,175	21.07
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,095	3.74
Equipment		1,914	6.53
System Miscellaneous			
Fans		10,506	35.86
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	565	20,791	
Unit Cost	$0.608	$0.060	
Dollar Cost	$343	$1,247	$1,591
Site Energy (MBTU)	56.5	71.0	127.4
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

RIVER VILLAGE 1600 AREA
INSTALL PROGRAMMABLE THERMOSTATS/NEW WHOLE HOUSE FANS

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	598	565	33	5.5
Electricity	kWh	24,586	20,791	3,795	15.4
Gas	Dollars	363	343	20	5.5
Electricity	Dollars	1,475	1,247	228	15.4
Annual Totals	Dollars	1,839	1,591	248	13.5
Gas	MBTU	59.795	56.489	3.306	5.5
Electricity	MBTU	83.912	70.959	12.953	15.4
Annual Totals	MBTU	143.708	127.448	16.260	11.3

ASEAM3 Report: Monthly Energy Consumption Date: 12-28-1994

RIVER VILLAGE 1600 AREA
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	87	0	1,512	0.0	0.0
Feb	69	0	1,371	0.0	0.0
Mar	57	0	1,493	0.0	0.0
Apr	40	0	1,760	0.0	0.0
May	38	0	2,248	0.0	0.0
Jun	36	0	2,512	0.0	0.0
Jul	36	0	2,708	0.0	0.0
Aug	37	0	2,690	0.0	0.0
Sep	36	0	2,352	0.0	0.0
Oct	39	0	1,942	0.0	0.0
Nov	52	0	1,446	0.0	0.0
Dec	75	0	1,523	0.0	0.0
Ann	601	0	23,556	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	87	0	1,512	0.0	0.0
Feb	156	0	2,883	0.0	0.0
Mar	213	0	4,376	0.0	0.0
Apr	253	0	6,136	0.0	0.0
May	291	0	8,383	0.0	0.0
Jun	327	0	10,896	0.0	0.0
Jul	363	0	13,603	0.0	0.0
Aug	400	0	16,293	0.0	0.0
Sep	436	0	18,646	0.0	0.0
Oct	474	0	20,588	0.0	0.0
Nov	526	0	22,034	0.0	0.0
Dec	601	0	23,556	0.0	0.0

RIVER VILLAGE 1600 AREA
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	145		14.49
Cooling Energy			
Direct Expansion		6,029	20.58
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		695	2.37
Equipment		1,914	6.53
System Miscellaneous			
Fans		13,818	47.16
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	601	23,556	
Unit Cost	$0.608	$0.060	
Dollar Cost	$366	$1,413	$1,779
Site Energy (MBTU)	60.1	80.4	140.5
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

RIVER VILLAGE 1600 AREA
REPLACE 3 LIGHT FIXTURES WITH FLUORESCENT TYPE

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	598	601	-3	-0.6
Electricity	kWh	24,586	23,556	1,030	4.2
Gas	Dollars	363	366	-2	-0.6
Electricity	Dollars	1,475	1,413	62	4.2
Annual Totals	Dollars	1,839	1,779	60	3.3
Gas	MBTU	59.795	60.129	-0.334	-0.6
Electricity	MBTU	83.912	80.398	3.515	4.2
Annual Totals	MBTU	143.708	140.526	3.181	2.2

ASEAM3 Report: Monthly Energy Consumption　　Date: 12-28-1994

RIVER VILLAGE 1600 AREA
MULTIPLE ECO'S

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	81	0	1,179	0.0	0.0
Feb	62	0	1,074	0.0	0.0
Mar	53	0	1,176	0.0	0.0
Apr	39	0	1,388	0.0	0.0
May	38	0	1,953	0.0	0.0
Jun	36	0	2,232	0.0	0.0
Jul	36	0	2,421	0.0	0.0
Aug	37	0	2,401	0.0	0.0
Sep	36	0	2,071	0.0	0.0
Oct	39	0	1,646	0.0	0.0
Nov	48	0	1,143	0.0	0.0
Dec	69	0	1,190	0.0	0.0
Ann	573	0	19,875	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	81	0	1,179	0.0	0.0
Feb	143	0	2,253	0.0	0.0
Mar	196	0	3,429	0.0	0.0
Apr	235	0	4,818	0.0	0.0
May	273	0	6,771	0.0	0.0
Jun	308	0	9,003	0.0	0.0
Jul	344	0	11,424	0.0	0.0
Aug	381	0	13,825	0.0	0.0
Sep	417	0	15,896	0.0	0.0
Oct	456	0	17,542	0.0	0.0
Nov	504	0	18,685	0.0	0.0
Dec	573	0	19,875	0.0	0.0

RIVER VILLAGE 1600 AREA
MULTIPLE ECO'S

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	116		11.63
Cooling Energy			
Direct Expansion		5,991	20.45
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		695	2.37
Equipment		1,914	6.53
System Miscellaneous			
Fans		10,175	34.73
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	573	19,875	
Unit Cost	$0.608	$0.060	
Dollar Cost	$348	$1,192	$1,541
Site Energy (MBTU)	57.3	67.8	125.1
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

RIVER VILLAGE 1600 AREA
MULTIPLE ECO'S

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	598	573	25	4.2
Electricity	kWh	24,586	19,875	4,712	19.2
Gas	Dollars	363	348	15	4.2
Electricity	Dollars	1,475	1,192	283	19.2
Annual Totals	Dollars	1,839	1,541	298	16.2
Gas	MBTU	59.795	57.266	2.529	4.2
Electricity	MBTU	83.912	67.832	16.080	19.2
Annual Totals	MBTU	143.708	125.098	18.609	12.9

Appendix E

BLCC Input Data

BLCC Input Data

Gerber Village 100 Area
No Basement

1998	-0.37	2.20
1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30
2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

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**********************************************************************
*          N I S T  B L C C 4.0  I N P U T  D A T A  L I S T I N G  *
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```

FILE NAME: GV1ABASE
FILE LAST MODIFIED ON 12-27-1994/16:40:20
PROJECT ALTERNATIVE: GV100-NO BST
COMMENT: GERBER VILLATE 100-NO BASEMENT: BASELINE

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

No non-annually-recurring OM&R costs reported.

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	46479	1346
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.060	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	Modified DOE	Modified DOE
1995	-0.34	1.64
1996	-0.31	1.13
1997	-0.34	1.68
1998	-0.37	2.20
1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30

2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

BLCC Input Data

Gerber Village 100 Area with Basement

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***********************************************************************
*         N I S T  B L C C 4.0  I N P U T  D A T A  L I S T I N G     *
***********************************************************************
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FILE NAME: GV1BBASE
FILE LAST MODIFIED ON 12-28-1994/09:05:53
PROJECT ALTERNATIVE: GV100 W/BSMT
COMMENT: GERBER VILLAGE 100 AREA W/ BASEMENT

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

No non-annually-recurring OM&R costs reported.

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	43471	1318
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.060	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	Modified DOE	Modified DOE
1995	-0.34	1.64
1996	-0.31	1.13
1997	-0.34	1.68
1998	-0.37	2.20
1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30

2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

****
*   N I S T   B L C C 4.0   I N P U T   D A T A   L I S T I N G   *
****

FILE NAME: GBMULECO
FILE LAST MODIFIED ON 12-28-1994/09:08:49
PROJECT ALTERNATIVE: GB/MULTIECOS
COMMENT: GERBER VILLAGE 100 AREA W/ BSMT: MULTIPLE ECO'S

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	4,926
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

NON-AN RECURRING OM&R COSTS (YRS/MTHS FROM SERVICE DATE; COST IN BASE YEAR $):

Y/M	COST
5/0	25
10/0	25
15/0	25
20/0	25

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	26448	701
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.060	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	Modified DOE	Modified DOE
1995	-0.34	1.64
1996	-0.31	1.13
1997	-0.34	1.68

1998	-0.37	2.20
1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30
2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

BLCC Input Data

166-171 Area

****
*   N I S T   B L C C 4.0   I N P U T   D A T A   L I S T I N G   *
****

FILE NAME: 166BASE
FILE LAST MODIFIED ON 12-28-1994/12:51:16
PROJECT ALTERNATIVE: 166-171 BASE
COMMENT: 166-171 AREA DUPLEX UNITS: BASE

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

No non-annually-recurring OM&R costs reported.

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	38214	907
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.060	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	Modified DOE	Modified DOE
1995	-0.34	1.64
1996	-0.31	1.13
1997	-0.34	1.68
1998	-0.37	2.20
1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30

2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

```
***********************************************************************
*        N I S T  B L C C 4.0  I N P U T  D A T A  L I S T I N G       *
***********************************************************************
```

FILE NAME: 66MULECO
FILE LAST MODIFIED ON 01-19-1995/14:12:51
PROJECT ALTERNATIVE: 166 MULTIECO
COMMENT: 166-171 AREA DUPLEX UNITS: MULTIPLE ECO'S

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	4,786
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

NON-AN RECURRING OM&R COSTS (YRS/MTHS FROM SERVICE DATE; COST IN BASE YEAR $):

Y/M	COST
5/0	25
10/0	25
15/0	25
20/0	25

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	26620	644
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.060	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	Modified DOE	Modified DOE
1995	-0.34	1.64
1996	-0.31	1.13
1997	-0.34	1.68
1998	-0.37	2.20

1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30
2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

BLCC Input Data

400 Area 'T' Shape

```
************************************************************************
*         N I S T  B L C C 4.0  I N P U T  D A T A  L I S T I N G      *
************************************************************************
```

FILE NAME: 400TBASE
FILE LAST MODIFIED ON 12-28-1994/11:49:19
PROJECT ALTERNATIVE: 400 'T'SHAPE
COMMENT: 400 AREA 'T' SHAPE HOUSES

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

No non-annually-recurring OM&R costs reported.

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	32587	1039
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.060	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	Modified DOE	Modified DOE
1995	-0.34	1.64
1996	-0.31	1.13
1997	-0.34	1.68
1998	-0.37	2.20
1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30

2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

```
*************************************************************************
*          N I S T  B L C C 4.0  I N P U T  D A T A  L I S T I N G      *
*************************************************************************
```

FILE NAME: 4TMULECO
FILE LAST MODIFIED ON 01-23-1995/14:12:04
PROJECT ALTERNATIVE: 4T/MULTI.ECO
COMMENT: 400 AREA 'T'SHAPE HOUSES: MULTIPLE ECO'S

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	1,669
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

NON-AN RECURRING OM&R COSTS (YRS/MTHS FROM SERVICE DATE; COST IN BASE YEAR $):

Y/M	COST
5/0	25
10/0	25
15/0	25
20/0	25

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	26418	951
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.060	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	Modified DOE	Modified DOE
1995	-0.34	1.64
1996	-0.31	1.13
1997	-0.34	1.68

1998	-0.37	2.20
1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30
2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

BLCC Input Data

400 Area 'L' Shape

```
*************************************************************************
*        N I S T  B L C C 4.0  I N P U T  D A T A  L I S T I N G        *
*************************************************************************
```

FILE NAME: 400LBASE
FILE LAST MODIFIED ON 12-28-1994/11:50:41
PROJECT ALTERNATIVE: 400 'L'SHAPE
COMMENT: 400 AREA 'L' SHAPE HOUSES

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

No non-annually-recurring OM&R costs reported.

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	33868	1200
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.060	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	Modified DOE	Modified DOE
1995	-0.34	1.64
1996	-0.31	1.13
1997	-0.34	1.68
1998	-0.37	2.20
1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30

2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

```
*************************************************************************
*          N I S T   B L C C 4.0   I N P U T   D A T A   L I S T I N G  *
*************************************************************************
```

FILE NAME: 4LMULECO
FILE LAST MODIFIED ON 01-23-1995/14:15:22
PROJECT ALTERNATIVE: 4L/MULTI.ECO
COMMENT: 400 AREA 'L'SHAPE HOUSES: MULTIPLE ECO'S

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	3,365
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

NON-AN RECURRING OM&R COSTS (YRS/MTHS FROM SERVICE DATE; COST IN BASE YEAR $):

Y/M	COST
5/0	25
10/0	25
15/0	25
20/0	25

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	22166	719
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.060	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	Modified DOE	Modified DOE
1995	-0.34	1.64
1996	-0.31	1.13
1997	-0.34	1.68
1998	-0.37	2.20

1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30
2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

BLCC Input Data

River Village 1600 Area

```
*********************************************************************
*        N I S T   B L C C 4.0   I N P U T   D A T A   L I S T I N G        *
*********************************************************************
```

FILE NAME: RVFANPT
FILE LAST MODIFIED ON 12-28-1994/13:23:51
PROJECT ALTERNATIVE: RV-FAN/TSTAT
COMMENT: RV1600 AREA:WHOLE HOUSE FANS AND PROGRAM. T'STATS

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	1,269
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

NON-AN RECURRING OM&R COSTS (YRS/MTHS FROM SERVICE DATE; COST IN BASE YEAR $):

Y/M	COST
5/0	25
10/0	25
15/0	25
20/0	25

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

		TYPE 1	TYPE 2
ENERGY TYPE:		Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:		20791	565
UNITS:		kWh	Therm
PRICE PER UNIT ($):		0.060	0.608
ANNUAL DEMAND CHARGE ($):		0.00	0.00
ESCALATION RATE METHOD:		Modified DOE	Modified DOE
	1995	-0.34	1.64
	1996	-0.31	1.13
	1997	-0.34	1.68

1998	-0.37	2.20
1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30
2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

```
************************************************************************
*        N I S T  B L C C 4.0  I N P U T  D A T A  L I S T I N G       *
************************************************************************
```

FILE NAME: RVFLUOLT
FILE LAST MODIFIED ON 12-28-1994/13:26:30
PROJECT ALTERNATIVE: RV FLUOLIGHT
COMMENT: RIVER VILLAGE 1600 AREA:REPLACE 3 LIGHT FIXTURES

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1995
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1995
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 3.1%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	353
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

No non-annually-recurring OM&R costs reported.

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 2
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Commercial
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1	TYPE 2
ENERGY TYPE:	Electricity	Natural Gas
BASE ANNUAL CONSUMPTION:	23556	601
UNITS:	kWh	Therm
PRICE PER UNIT ($):	0.060	0.608
ANNUAL DEMAND CHARGE ($):	0.00	0.00
ESCALATION RATE METHOD:	Modified DOE	Modified DOE
1995	-0.34	1.64
1996	-0.31	1.13
1997	-0.34	1.68
1998	-0.37	2.20
1999	0.46	2.60
2000	0.39	2.89
2001	-0.27	3.06
2002	-0.07	3.30

2003	0.15	2.96
2004	-0.12	2.10
2005	-0.34	1.45
2006	-0.29	1.20
2007	-0.15	1.33
2008	-0.29	0.59
2009	-0.32	0.22
2010	0.00	1.23
2011	0.07	1.79
2012	0.05	1.83
2013	0.05	1.80
2014	0.07	1.77

Appendix F

BLCC Output

BLCC Comparative Analysis - GV1A

Gerber Village 100 Area

(No Basement)

BLCC 4.0: COMPARATIVE ECONOMIC ANALYSIS

BASE CASE: GV100-NO BST
ALTERNATIVE: GA/MULTI-ECO

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 20.00 YEARS (JAN 1995 THROUGH DEC 2014)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: GV1ABASE.LCC
ALTERNATIVE LCC FILE: GAMULECO.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: GV100-NO BST	ALTERNATIVE: GA/MULTI-ECO	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$6,145	-$6,145
SUBTOTAL	$0	$6,145	-$6,145
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$0	$69	-$69
ENERGY EXPENDITURES	$55,235	$32,329	$22,906
SUBTOTAL	$55,235	$32,398	$22,837
TOTAL P.V. LIFE-CYCLE COST	$55,235	$38,543	$16,692

NET SAVINGS FROM ALTERNATIVE GA/MULTI-ECO COMPARED TO ALTERNATIVE GV100-NO BST

Net Savings =	P.V. of non-investment savings	$22,837
-	Increased total investment	$6,145
	Net Savings:	$16,692

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE GA/MULTI-ECO COMPARED TO ALTERNATIVE GV100-NO BST

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 3.72$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE GA/MULTI-ECO COMPARED TO ALTERNATIVE GV100-NO BST
(Reinvestment rate = 3.10%; Study period = 20 years)

AIRR = 10.09%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 5
Discounted Payback occurs in year 5

ENERGY SAVINGS SUMMARY

Energy type	Units	---Annual Consumption--- Base Case	Alternative	Energy Savings
Electricity	kWh	46,479	27,774	18,705
Natural Gas	Therm	1,346	742	604

BLCC Comparative Analysis - GV1B

Gerber Village 100 Area

(With Basement)

BLCC 4.0: COMPARATIVE ECONOMIC ANALYSIS

BASE CASE: GV100 W/BSMT
ALTERNATIVE: GB/MULTIECOS

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 20.00 YEARS (JAN 1995 THROUGH DEC 2014)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: GV1BBASE.LCC
ALTERNATIVE LCC FILE: GBMULECO.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: GV100 W/BSMT	ALTERNATIVE: GB/MULTIECOS	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$4,926	-$4,926
SUBTOTAL	$0	$4,926	-$4,926
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$0	$69	-$69
ENERGY EXPENDITURES	$52,303	$30,725	$21,578
SUBTOTAL	$52,303	$30,794	$21,509
TOTAL P.V. LIFE-CYCLE COST	$52,303	$35,720	$16,583

NET SAVINGS FROM ALTERNATIVE GB/MULTIECOS COMPARED TO ALTERNATIVE GV100 W/BSMT

Net Savings	=	P.V. of non-investment savings	$21,509
	-	Increased total investment	$4,926
		Net Savings:	$16,583

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE GB/MULTIECOS COMPARED TO ALTERNATIVE GV100 W/BSMT

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 4.37$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE GB/MULTIECOS COMPARED TO ALTERNATIVE GV100 W/BSMT
(Reinvestment rate = 3.10%; Study period = 20 years)

AIRR = 10.99%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 4
Discounted Payback occurs in year 4

ENERGY SAVINGS SUMMARY

Energy type	Units	---Annual Consumption--- Base Case	Alternative	Energy Savings
Electricity	kWh	43,471	26,448	17,023
Natural Gas	Therm	1,318	701	617

BLCC Comparative Analysis - 166

166-171 Area

BLCC 4.0: COMPARATIVE ECONOMIC ANALYSIS

BASE CASE: 166-171 BASE
ALTERNATIVE: 166 MULTIECO

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 20.00 YEARS (JAN 1995 THROUGH DEC 2014)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 166BASE.LCC
ALTERNATIVE LCC FILE: 66MULECO.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: 166-171 BASE	ALTERNATIVE: 166 MULTIECO	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$4,786	-$4,786
SUBTOTAL	$0	$4,786	-$4,786
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$0	$69	-$69
ENERGY EXPENDITURES	$43,242	$30,255	$12,987
SUBTOTAL	$43,242	$30,324	$12,918
TOTAL P.V. LIFE-CYCLE COST	$43,242	$35,110	$8,132

NET SAVINGS FROM ALTERNATIVE 166 MULTIECO COMPARED TO ALTERNATIVE 166-171 BASE

Net Savings =	P.V. of non-investment savings	$12,918
-	Increased total investment	$4,786
	Net Savings:	$8,132

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE 166 MULTIECO COMPARED TO ALTERNATIVE 166-171 BASE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 2.70$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE 166 MULTIECO COMPARED TO ALTERNATIVE 166-171 BASE
(Reinvestment rate = 3.10%; Study period = 20 years)

AIRR = 8.35%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 6
Discounted Payback occurs in year 7

ENERGY SAVINGS SUMMARY

Energy type	Units	---Annual Consumption--- Base Case	Alternative	Energy Savings
Electricity	kWh	38,214	26,620	11,594
Natural Gas	Therm	907	644	263

BLCC Comparative Analysis - 400T

400 Area "T" Shape

BLCC 4.0: COMPARATIVE ECONOMIC ANALYSIS

BASE CASE: 400 'T'SHAPE
ALTERNATIVE: 4T/MULTI.ECO

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 20.00 YEARS (JAN 1995 THROUGH DEC 2014)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 400TBASE.LCC
ALTERNATIVE LCC FILE: 4TMULECO.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: 400 'T'SHAPE	ALTERNATIVE: 4T/MULTI.ECO	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$1,669	-$1,669
SUBTOTAL	$0	$1,669	-$1,669
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$0	$69	-$69
ENERGY EXPENDITURES	$39,762	$33,416	$6,346
SUBTOTAL	$39,762	$33,486	$6,276
TOTAL P.V. LIFE-CYCLE COST	$39,762	$35,155	$4,607

NET SAVINGS FROM ALTERNATIVE 4T/MULTI.ECO COMPARED TO ALTERNATIVE 400 'T'SHAPE

Net Savings	=	P.V. of non-investment savings	$6,276
	-	Increased total investment	$1,669
		Net Savings:	$4,607

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE 4T/MULTI.ECO COMPARED TO ALTERNATIVE 400 'T'SHAPE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 3.76$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE 4T/MULTI.ECO COMPARED TO ALTERNATIVE 400 'T'SHAPE
(Reinvestment rate = 3.10%; Study period = 20 years)

AIRR = 10.16%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 4
Discounted Payback occurs in year 5

ENERGY SAVINGS SUMMARY

Energy type	Units	---Annual Consumption--- Base Case	Alternative	Energy Savings
Electricity	kWh	32,587	26,418	6,169
Natural Gas	Therm	1,039	951	88

BLCC Comparative Analysis - 400L

400 Area "L" Shape

BLCC 4.0: COMPARATIVE ECONOMIC ANALYSIS

BASE CASE: 400 'L'SHAPE
ALTERNATIVE: 4L/MULTI.ECO

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 20.00 YEARS (JAN 1995 THROUGH DEC 2014)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: 400LBASE.LCC
ALTERNATIVE LCC FILE: 4LMULECO.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: 400 'L'SHAPE	ALTERNATIVE: 4L/MULTI.ECO	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$3,365	-$3,365
SUBTOTAL	$0	$3,365	-$3,365
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$0	$69	-$69
ENERGY EXPENDITURES	$42,631	$27,180	$15,452
SUBTOTAL	$42,631	$27,249	$15,382
TOTAL P.V. LIFE-CYCLE COST	$42,631	$30,614	$12,017

NET SAVINGS FROM ALTERNATIVE 4L/MULTI.ECO COMPARED TO ALTERNATIVE 400 'L'SHAPE

Net Savings =	P.V. of non-investment savings	$15,382
-	Increased total investment	$3,365
	Net Savings:	$12,017

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE 4L/MULTI.ECO COMPARED TO ALTERNATIVE 400 'L'SHAPE

$$\text{SIR} = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 4.57$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE 4L/MULTI.ECO COMPARED TO ALTERNATIVE 400 'L'SHAPE
(Reinvestment rate = 3.10%; Study period = 20 years)

AIRR = 11.24%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 4
Discounted Payback occurs in year 4

ENERGY SAVINGS SUMMARY

Energy type	Units	---Annual Consumption---		Energy Savings
		Base Case	Alternative	
Electricity	kWh	33,868	22,166	11,702
Natural Gas	Therm	1,200	719	481

BLCC Comparative Analysis - RV 16

River Village 1600 Area

BLCC 4.0: COMPARATIVE ECONOMIC ANALYSIS

BASE CASE: RV 1600 AREA
ALTERNATIVE: RV-FAN/TSTAT

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 20.00 YEARS (JAN 1995 THROUGH DEC 2014)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: RV16BASE.LCC
ALTERNATIVE LCC FILE: RVFANPT.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: RV 1600 AREA	ALTERNATIVE: RV-FAN/TSTAT	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$1,269	-$1,269
SUBTOTAL	$0	$1,269	-$1,269
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$0	$69	-$69
ENERGY EXPENDITURES	$27,978	$24,304	$3,674
SUBTOTAL	$27,978	$24,374	$3,605
TOTAL P.V. LIFE-CYCLE COST	$27,978	$25,643	$2,336

NET SAVINGS FROM ALTERNATIVE RV-FAN/TSTAT COMPARED TO ALTERNATIVE RV 1600 AREA

Net Savings	=	P.V. of non-investment savings	$3,605
	-	Increased total investment	$1,269
		Net Savings:	$2,336

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE RV-FAN/TSTAT COMPARED TO ALTERNATIVE RV 1600 AREA

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 2.84$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE RV-FAN/TSTAT COMPARED TO ALTERNATIVE RV 1600 AREA
(Reinvestment rate = 3.10%; Study period = 20 years)

AIRR = 8.62%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 6
Discounted Payback occurs in year 6

ENERGY SAVINGS SUMMARY

Energy type	Units	---Annual Consumption--- Base Case	Alternative	Energy Savings
Electricity	kWh	24,586	20,791	3,795
Natural Gas	Therm	598	565	33

BLCC 4.0: COMPARATIVE ECONOMIC ANALYSIS

BASE CASE: RV 1600 AREA
ALTERNATIVE: RV FLUOLIGHT

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 20.00 YEARS (JAN 1995 THROUGH DEC 2014)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: RV16BASE.LCC
ALTERNATIVE LCC FILE: RVFLUOLT.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: RV 1600 AREA	ALTERNATIVE: RV FLUOLIGHT	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$353	-$353
SUBTOTAL	$0	$353	-$353
FUTURE COST ITEMS:			
ENERGY EXPENDITURES	$27,978	$27,111	$867
SUBTOTAL	$27,978	$27,111	$867
TOTAL P.V. LIFE-CYCLE COST	$27,978	$27,464	$514

NET SAVINGS FROM ALTERNATIVE RV FLUOLIGHT COMPARED TO ALTERNATIVE RV 1600 AREA

Net Savings =	P.V. of non-investment savings	$867
-	Increased total investment	$353
	Net Savings:	$514

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE RV FLUOLIGHT COMPARED TO ALTERNATIVE RV 1600 AREA

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 2.46$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE RV FLUOLIGHT COMPARED TO ALTERNATIVE RV 1600 AREA
(Reinvestment rate = 3.10%; Study period = 20 years)

AIRR = 7.84%

ESTIMATED YEARS TO PAYBACK

Simple Payback occurs in year 6
Discounted Payback occurs in year 7

ENERGY SAVINGS SUMMARY

Energy type	Units	---Annual Consumption--- Base Case	Alternative	Energy Savings
Electricity	kWh	24,586	23,556	1,030
Natural Gas	Therm	598	601	-3

Appendix G:

Miscellaneous Analyses

ECOs Analyzed and Recommended

1. **Light Fixture Replacement**
2. **Insulation of Domestic Water Heater**

ECOs Analyzed and Rejected:

1. **Basement wall insulation:**
   Analyzed via ASEAM and BLCC.
2. **Attic fan installation:**
   Energy consumptions from manual calculations are used in BLCC input.

FT. BELVOIR - HOUSING ECO

BASIS OF LIGHT FIXTURE REPLACEMENT AND RE-LAMPING ANALYSIS

A. ASSUMPTIONS

1. Life expectancy of incandescent light bulbs: 750 hrs.
   Life expectancy of fluorescent tubes: 7,500 hrs.
2. Each light bulb/tube is ON for an average of 4.0 hrs/day, 365 days/year (=1,460 hrs/year)
3. Cost of electricity: $ 0.06/kWH
4. A 32-watt (T-8) tube is equivalent to two 60-watt incandescent bulbs (approx. 800 lumins each)

B. Energy Consumption Comparison (annual)

1. Incandescent bulbs
   60 watts x 2 x 1,460 hrs/yr ÷ 1000 kW/watt = 175 kWh/yr

2. Fluorescent tube
   32 watts x 1,460 hrs/yr ÷ 1000 kW/watt = 47 kWh/yr

3. Energy Savings: (175-47) kWh/yr = 128 kWh/yr/fixture

C. First Cost of Each 1-Lamp Fluorescent Fixtures:

Material	$ 65.00
Labor	$ 40.00
Total	$105.00

D. Maintenance/replacement Cost Comparison (annual)

1. Incandescent bulbs (replaced every 6 months)
   a. Material $ 0.50 each bulb
   b. Labor 0

2. Fluorescent tubes (replaced every 5 years)
   a. Material $ 3.00 each tube
   b. Labor 0

3. Comparison of annual M/R costs (based on 3 fixtures per housing unit):
   a. Incandescent $ (0.50 x 2 x 3) = $ 3.00/yr
   b. Fluorescent $ (3.00 x 3 x 0.2) = $ 1.80/yr

E. Life Cycle Cost Analysis: See 'BLCC' printouts.

F. Comments

1. According to the Office of Housing, there is no cost of maintenance service calls involved in light bulb replacement, as it is typically done by the tenants. It is therefore assumed that replacement of fluorescent

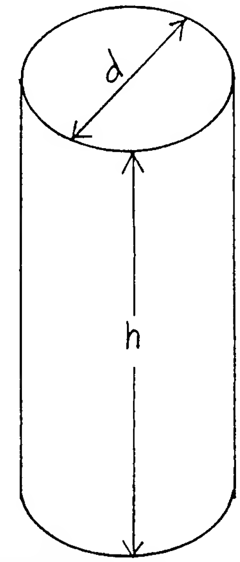
tubes will be done by the tenants, too.

2. In the energy and life cycle cost analyses only 3 existing fixtures per housing unit (all on first floor) are targeted for replacement, since it became obvious that any fixtures used less than 4 hours/day consistently would justify the cost of conversion.

3. Re-lamping existing incandescent fixtures with fluorescent tubes is a proven high-return investment. Though not qualified as an ECIP project, it should be done wherever the conversion is feasible without replacing the fixture.

4. According to GE, 40-watt "Cool-White" (T-12) fluorescent tubes, which are 40% cheaper than T-8, will be eliminated by 1995. T-12 tubes therefore are not considered for this study in all energy analysis.

TYPICAL DOMESTIC WATER HEATER :



$d = 20'' \pm$
$h = 48'' \pm$

∴ SURFACE AREA 'INSULATABLE'

$$= \frac{20 \times \pi \times 48}{144} \text{ SF}$$

$$\simeq 21 \text{ SF}$$

ASSUMPTIONS

1. WATER TEMPERATURE SETTING = 120°F (CONSTANT)
2. EXISTING INSULATION = 3/4" FIBERGLASS
3. NEW INSULATING JACKET = 3/4" FIBERGLASS

CALCULATIONS

A. EXISTING U-VALUE OF HEATER INSULATION

(1): 3/4" FIBERGLASS BATT $\simeq R_1 = 2.3$
$+ 1/f_o = 1.35$ (*)
$3.65 \Rightarrow U_1 = 0.274$

(2) WITH NEW INSULATING JACKET $R_2 \cong 4.6$
$1/f_o = 1.35$
$5.95 \Rightarrow U_2 = 0.168$

B. $U_1 - U_2 = \Delta U = 0.274 - 0.168$
$= 0.106$ SAY 0.10

(*) SURFACE RESISTANCE, REFLECTIVE (TABLE 1, ASHRAE HF 23.3) 1985

Einhorn Yaffee Prescott
ARCHITECTURE & ENGINEERING, P.C

Project Name FT. BELVOIR (ECO) Project No. 60592.00
Calculated by J. STONE Date
Checked by Date
~~Scale~~ INSULATION OF DOM. WATER HEATER Sheet No. 2 of 3

C. HEAT LOSS REDUCTION (SAVINGS)

*BASED ON AVERAGE OUTDOOR TEMPERATURE OF 54.5°F

$21 \times 0.10 \times (120 - 54.5) \times 8760$ BTU/YR
= 1,204,938 BTU/YR (**)
⇒ 12.0 THERMS.

AT HEATER EFFICIENCY OF 65%, AND \$0.608/THERM (NATURAL GAS), SAVINGS
$= 12/0.65 \times \$0.608 = 18.5 \times \$0.608$

$\cong$ \$11.22/YR.

D. FIRST COST : \$ 17.00
INSTALLATION : 25.00
\$ 42.00

(**) EXISTING CONDITION (HEAT LOSS) :

$21 \times 0.274 \times (120 - 54.5) \times 8760$ BTU/YR
= 3,301,530 BTU/YR
$\sim 3.3 \times 10^6$ BTU/YR. (OUTPUT)
⇒ 50.8 THERMS/YR (INPUT)

NEW CONDITION :
$(3.3 \times 10^6 - 1.2 \times 10^6)$ BTU/YR.
$= 2.1 \times 10^6$ BTU/YR (OUTPUT)
$\Rightarrow \frac{2.1 \times 10^6}{0.65}$ BTU/YR OR 32.3 THERMS/YR (INPUT)

CALCULATION OF AVG. TEMP. FOR FT. BELVOIR

97	x	7	=	679
92	x	82	=	7,544
87	x	273	=	23,751
82	x	445	=	36,490
77	x	632	=	48,664
72	x	857	=	61,704
67	x	812	=	54,404
62	x	709	=	43,958
57	x	706	=	40,242
52	x	653	=	33,956
47	x	639	=	30,033
42	x	717	=	30,114
37	x	691	=	25,567
32	x	644	=	20,608
27	x	436	=	11,772
22	x	236	=	5,192
17	x	122	=	2,074
12	x	63	=	756
7	x	24	=	168
2	x	8	=	16
-3	x	2	=	-6
-8	x	1	=	-8
		8760		477,678

$$\frac{477{,}678}{8760} = 54.53\ ^\circ F \text{ (AVERAGE)}$$

USE $54.5\ ^\circ F$

(SOURCE: TM 5-785)
* ATTACHED

Weather Data for Ft. Belvoir

TM 5-785

41 03 112 55 4422 4 8 N [illegible] [illegible]840 97 62 95 61 30 W 93 60 66 65 63 174 1069 [illegible] 19

STATE / Station	Location Lat (° ′)	Location Long (° ′)	Elev (feet)	Winter Dry Bulb 99% (°F)	Winter Dry Bulb 97.5% (°F)	Pvlg Wind (dir)	Mean Speed (knots)	Degree Days Heating (annual)	Summer Dry Bulb 1% (°F)	MCWB (°F)	2.5% (°F)	MCWB (°F)	Mean Daily Range (°F)	Pvlg Wind (dir)	5% (°F)	MCWB (°F)	Wet Bulb 1% (°F)	Wet Bulb 2.5% (°F)	Wet Bulb 5% (°F)	Criteria Dry Bulb ≥ 93°F (hrs)	≥ 80°F (hrs)	Criteria Wet Bulb ≥ 73°F (hrs)	≥ 67°F (hrs)
UTAH (CONT)	N	W																					
Ogden MAP	41 12	112 01	4455	1	5	S	6	6012	93	63	91	61	26	SW	88	61	66	65	64	37	727	0	19
Provo	40 13	111 43	4448	1	6	SE	5	5720	98	62	96	62	32	SW	94	61	66	65	64	185	989	0	26
Salt Lake City IAP	40 46	111 58	4220	3	8	SSE	6	5983	97	62	95	62	32	N	92	61	66	65	64	139	932	0	26
Tooele Army Depot	40 31	112 25	4700	4	7	SE	4	5941	93	61	91	61	24	N	88	60	65	64	63	41	704	0	5
Utah Army Depot	41 15	112 00	4270	2	6	S	6	6012	94	63	92	61	26	SW	89	61	66	65	64	59	849	0	19
Wendover AF Range	40 44	114 02	4237	8	12	ENE	4	5673	97	60	95	59	25	E	93	59	65	64	62	158	1144	0	4
VERMONT	N	W																					
Burlington IAP	44 28	73 09	332	-12	-7	E	7	7876	88	72	85	70	24	SSW	82	69	74	72	71	4	263	67	546
St Albans AFS	44 46	73 03	1310	-17	-11	E	9	8790	85	70	82	68	24	SSW	79	67	72	70	69	1	119	21	307
VIRGINIA	N	W																					
Arlington Hall	38 52	77 06	200	13	17	WNW	11	4211	94	75	91	74	21	S	89	74	78	77	76	55	815	580	1744
Bedford AFS	37 31	79 30	4220	-3	1	NW	9	7382	82	66	80	66	22	SW	77	65	69	68	67	0	87	0	216
Cameron Station	38 48	77 07	60	13	17	WNW	11	4211	94	75	91	74	21	S	89	74	78	77	76	55	815	580	1744
Camp A P Hill	38 08	77 21	230	10	14	NW	6	4398	96	77	93	76	21	S	90	75	80	78	77	90	897	710	1884
Camp Pickett/Blackstone AAF	37 05	77 57	390	15	19	NW	6	3841	95	77	92	76	22	SW	90	76	79	78	77	66	905	804	2086
Cape Charles AFS	37 08	75 57	13	20	23	N	11	3474	90	77	88	76	17	SW	86	75	79	78	77	0	596	856	2184
Charlottesville	38 02	78 31	870	14	18	NE	7	4162	94	74	91	74	23	SW	88	73	77	76	75	54	964	376	1544
Dahlgren NAVSURFWPNCEN	38 20	77 02	21	10	14	NW	6	4498	93	77	91	76	21	S	89	75	80	78	77	39	892	710	1884
Dam Neck	36 47	75 57	10	19	22	N	11	3639	91	77	89	76	17	SW	87	75	79	78	77	12	708	856	2184
Dulles IAP	38 57	77 27	313	7	11	NW	9	5010	93	74	90	73	23	S	88	73	77	76	75	28	749	386	1417
Fort Belvoir/Davison AAF	38 43	77 11	69	8	12	NW	9	4891	92	76	90	75	23	S	88	74	78	77	76	23	781	551	1668
Fort Eustis/Felker AAF	37 08	76 37	12	17	20	N	10	3752	92	77	90	76	17	SSW	88	75	80	78	77	26	875	807	2065
Fort Lee	37 14	77 21	145	14	17	N	6	3939	95	76	92	76	22	SW	90	75	79	78	77	70	932	765	1973
Fort Lee AFS	37 14	77 20	75	14	17	N	6	3939	95	76	92	76	22	SW	90	75	79	78	77	70	932	765	1973
Fort Monroe	37 00	76 19	15	17	20	NW	9	3623	92	78	90	77	17	SW	87	76	79	78	77	21	809	1010	2290
Fort Myer	38 53	77 05	220	14	17	WNW	11	4211	93	75	91	74	19	S	89	74	78	77	76	41	910	580	1744
Fort Story	36 56	76 00	13	19	22	N	11	3639	91	77	89	76	17	SW	87	75	79	78	77	12	708	856	2184
Langley AFB/Hampton	37 05	76 21	10	17	20	NW	9	3623	92	78	90	77	17	SW	87	76	79	78	77	21	809	1010	2290
Little Creek NAVPHIBASE	36 54	76 09	15	20	22	NW	10	3488	93	77	91	76	19	SW	89	76	79	78	77	41	874	961	2238
Lynchburg MAP	37 20	79 12	916	12	16	NE	7	4233	93	74	90	74	23	SW	88	73	77	76	75	31	696	376	1544
Manassas/Davis Field	38 43	77 31	186	10	14	NW	6	4398	96	76	93	75	22	S	90	74	78	77	76	90	897	548	1650
Newport News/Patrick Henry	37 08	76 30	41	17	20	NW	9	3549	92	78	90	77	17	SW	87	76	79	78	77	21	809	1010	2290
Norfolk	36 54	76 12	22	20	22	NW	10	3488	93	77	91	76	19	SW	89	76	79	78	77	41	874	961	2238

G-7

FORT BELVOIR/DAVISON AAF VIRGINIA

LAT 38 43N LONG 77 11W ELEV 69 FT

MEAN FREQUENCY OF OCCURRENCE OF DRY BULB TEMPERATURE (DEGREES F) WITH MEAN COINCIDENT WET BULB TEMPERATURE (DEGREES F) FOR EACH DRY BULB TEMPERATURE RANGE

Temperature Range	MAY Obsn Hour Gp 01 to 08	MAY 09 to 16	MAY 17 to 24	MAY Total Obsn	MAY MCWB	JUNE Obsn Hour Gp 01 to 08	JUNE 09 to 16	JUNE 17 to 24	JUNE Total Obsn	JUNE MCWB	JULY Obsn Hour Gp 01 to 08	JULY 09 to 16	JULY 17 to 24	JULY Total Obsn	JULY MCWB
100/104							0		0	80		0		0	79
95/99		0	0	0	72		2	1	3	77		2	0	2	77
90/94		4	1	5	69		14	2	16	75		23	4	27	75
85/89		13	4	17	69	0	40	14	54	73	0	63	21	84	74
80/84	0	25	11	36	67	2	56	30	88	71	5	75	44	124	71
75/79	2	37	20	59	64	12	60	46	118	67	35	54	64	153	70
70/74	10	51	35	96	62	49	38	57	144	66	87	24	70	181	69
65/69	30	44	47	121	60	68	20	46	134	63	72	5	32	109	64
60/64	49	37	46	132	56	48	8	25	81	59	32	1	10	43	60
55/59	55	22	39	116	53	36	2	15	53	55	14		2	16	55
50/54	45	12	26	83	49	18		4	22	51	3		0	3	51
45/49	32	3	12	47	45	5		1	6	46					
40/44	17	1	6	24	40	2			2	42					
35/39	7		1	8	36										
30/34	2		0	2	31										
25/29	0			0	29										
20/24															

Temperature Range	AUGUST Obsn Hour Gp 01 to 08	AUGUST 09 to 16	AUGUST 17 to 24	AUGUST Total Obsn	AUGUST MCWB	SEPTEMBER Obsn Hour Gp 01 to 08	SEPTEMBER 09 to 16	SEPTEMBER 17 to 24	SEPTEMBER Total Obsn	SEPTEMBER MCWB	OCTOBER Obsn Hour Gp 01 to 08	OCTOBER 09 to 16	OCTOBER 17 to 24	OCTOBER Total Obsn	OCTOBER MCWB
100/104															
95/99		2	0	2	78		0		0	83					
90/94		20	4	24	76		7	1	8	75		1		1	69
85/89	0	55	18	73	74		31	6	37	73		2	0	2	71
80/84	2	74	38	114	72	0	41	15	56	70		8	1	9	68
75/79	29	61	61	151	70	8	51	34	93	68	0	23	4	27	66
70/74	82	30	71	183	68	38	46	48	132	66	6	39	16	61	63
65/69	73	6	34	113	64	49	34	43	126	62	16	49	30	95	60
60/64	35	1	15	51	60	42	20	40	102	58	25	48	39	112	56
55/59	21	0	6	27	55	46	8	31	85	54	36	42	45	123	52
50/54	6		1	7	51	32	2	15	49	50	46	25	43	114	48
45/49	1			1	46	16		6	22	45	41	8	33	82	44
40/44						7		1	8	42	32	2	22	56	40
35/39						1		0	1	36	28	0	11	39	35
30/34											15		3	18	31
25/29											4		1	5	27
20/24											0			0	23

FORT BELVOIR/DAVISON AAF VIRGINIA

FEBRUARY MARCH APRIL ANNUAL TOTAL Obsn Total M

FORT BELVOIR/DAVISON AAF VIRGINIA

Temperature Range	NOVEMBER Obsn Hour Gp 01 to 08	NOVEMBER Obsn Hour Gp 09 to 16	NOVEMBER Obsn Hour Gp 17 to 24	NOVEMBER Total Obsn	NOVEMBER MCWB	DECEMBER Obsn Hour Gp 01 to 08	DECEMBER Obsn Hour Gp 09 to 16	DECEMBER Obsn Hour Gp 17 to 24	DECEMBER Total Obsn	DECEMBER MCWB
100/104										
95/99										
90/94										
85/89		0		0	71					
80/84		0	0	0	69					
75/79		3	1	4	64		0		0	57
70/74	1	6	2	9	61	0	1	1	2	60
65/69	3	17	6	26	58	0	4	1	5	58
60/64	8	31	16	55	55	2	6	3	11	55
55/59	17	41	23	81	51	5	13	7	25	51
50/54	27	46	35	108	46	6	20	11	37	46
45/49	27	41	39	107	42	12	26	23	61	42
40/44	36	31	47	114	38	25	45	32	102	38
35/39	43	16	38	97	34	34	51	44	129	33
30/34	44	5	23	72	30	51	42	54	147	29
25/29	26	1	9	36	26	43	23	39	105	25
20/24	8	0	1	9	21	32	12	21	65	20
15/19	1		0	1	17	23	3	8	34	16
10/14						12	1	3	16	11
5/9						3	0	0	3	7
0/4						1		0	1	1
-5/-1						0			0	-1
-10/-6										

Temperature Range	JANUARY Obsn Hour Gp 01 to 08	JANUARY Obsn Hour Gp 09 to 16	JANUARY Obsn Hour Gp 17 to 24	JANUARY Total Obsn	JANUARY MCWB	FEBRUARY Obsn Hour Gp 01 to 08	FEBRUARY Obsn Hour Gp 09 to 16	FEBRUARY Obsn Hour Gp 17 to 24	FEBRUARY Total Obsn	FEBRUARY MCWB
100/104										
95/99										
90/94										
85/89										
80/84										
75/79										
70/74		1	0	1	60		1	0	1	58
65/69		1	1	2	59		2	1	3	57
60/64	1	3	1	5	53	0	3	3	6	53
55/59	2	7	4	13	50	2	10	6	18	49
50/54	3	11	7	21	45	5	15	9	29	45
45/49	7	27	15	49	41	8	26	14	48	41
40/44	19	39	29	87	38	16	42	38	96	37
35/39	30	45	42	117	33	35	44	44	123	33
30/34	45	49	50	144	29	44	39	47	130	29
25/29	45	31	46	122	24	47	25	35	107	24
20/24	36	18	26	80	20	29	10	16	55	20
15/19	28	11	14	53	15	17	4	7	28	15
10/14	17	4	7	28	11	12	2	3	17	11
5/9	9	1	4	14	7	6	0	0	6	6
0/4	4	0	1	5	2	2			2	2
-5/-1	2	0	0	2	-3					
-10/-6	1			1	-7					

Temperature Range	MARCH Obsn Hour Gp 01 to 08	MARCH Obsn Hour Gp 09 to 16	MARCH Obsn Hour Gp 17 to 24	MARCH Total Obsn	MARCH MCWB	APRIL Obsn Hour Gp 01 to 08	APRIL Obsn Hour Gp 09 to 16	APRIL Obsn Hour Gp 17 to 24	APRIL Total Obsn	APRIL MCWB
100/104										
95/99							0		0	69
90/94							1	0	1	68
85/89							5	1	6	65
80/84		2	0	2	62		11	5	16	62
75/79		4	2	6	59	0	14	7	21	60
70/74	0	8	4	12	57	2	20	13	35	58
65/69	1	11	6	18	55	8	30	22	60	56
60/64	3	13	10	26	52	17	37	31	85	53
55/59	7	21	18	46	48	27	40	36	103	49
50/54	8	32	24	64	44	34	39	43	116	46
45/49	21	45	38	104	41	44	28	40	112	42
40/44	39	50	48	137	37	49	13	29	91	39
35/39	53	36	44	133	33	33	2	9	44	34
30/34	56	18	34	108	29	19	0	4	23	30
25/29	32	7	15	54	25	6		1	7	26
20/24	19	2	5	26	20	1			1	21
15/19	5	0	1	6	16					
10/14	2		0	2	11					
5/9	1		0	1	7					
0/4	0			0	4					
-5/-1	0			0	-2					
-10/-6										

Temperature Range	ANNUAL TOTAL Obsn Hour Gp 01 to 08	ANNUAL TOTAL Obsn Hour Gp 09 to 16	ANNUAL TOTAL Obsn Hour Gp 17 to 24	ANNUAL TOTAL Total Obsn	ANNUAL TOTAL MCWB
100/104		0		0	79
95/99		6	1	7	77
90/94	0	70	12	82	75
85/89	0	209	64	273	73
80/84	9	292	144	445	70
75/79	86	307	239	632	68
70/74	275	265	317	857	66
65/69	320	223	269	812	62
60/64	262	208	239	709	57
55/59	268	206	232	706	52
50/54	233	202	218	653	47
45/49	214	204	221	639	42
40/44	242	223	252	717	38
35/39	264	194	233	691	33
30/34	276	153	215	644	29
25/29	203	87	146	436	25
20/24	125	42	69	236	20
15/19	74	18	30	122	16
10/14	43	7	13	63	11
5/9	19	1	4	24	7
0/4	7	0	1	8	2
-5/-1	2	0	0	2	-3
-10/-6	1			1	-7

G-9

ECO Analyzed and Rejected:

1. Basement wall insulation:
   Analyzed via ASEAM and BLCC.

2. Attic fan installation:
   Energy consumptions from manual calculations are used in BLCC input.

ASEAM3 Report: Monthly Energy Consumption Date: 06-15-1994

GERBER VILLAGE 100 AREA WITH BASEMENT
INSULATE BASEMENT WALLS

Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	247	0	2,847	0.0	0.0
Feb	188	0	2,568	0.0	0.0
Mar	143	0	2,767	0.0	0.0
Apr	73	0	2,620	0.0	0.0
May	38	0	4,187	0.0	0.0
Jun	36	0	4,695	0.0	0.0
Jul	36	0	5,070	0.0	0.0
Aug	37	0	5,035	0.0	0.0
Sep	36	0	4,389	0.0	0.0
Oct	39	0	3,596	0.0	0.0
Nov	121	0	2,672	0.0	0.0
Dec	214	0	2,860	0.0	0.0
Ann	1,206	0	43,306	0.0	0.0

Year-to-Date Totals

Totals Through Month	Natural Gas (Therms)	Oil (Gallons)	Electricity (kwh)	District Heating (MBTU)	District Cooling (MBTU)
Jan	247	0	2,847	0.0	0.0
Feb	434	0	5,415	0.0	0.0
Mar	577	0	8,183	0.0	0.0
Apr	650	0	10,802	0.0	0.0
May	688	0	14,989	0.0	0.0
Jun	724	0	19,684	0.0	0.0
Jul	760	0	24,754	0.0	0.0
Aug	796	0	29,789	0.0	0.0
Sep	832	0	34,178	0.0	0.0
Oct	871	0	37,774	0.0	0.0
Nov	992	0	40,446	0.0	0.0
Dec	1,206	0	43,306	0.0	0.0

GERBER VILLAGE 100 AREA WITH BASEMENT
INSULATE BASEMENT WALLS

* Building Annual Energy by *
* End Use and Fuel Type *

	Nat Gas (THERMS)	Electric (KWH)	Site (MBTU)
Heating Energy			
Gas Furnace	750		74.96
Cooling Energy			
Direct Expansion		11,015	37.59
Domestic Hot Water Energy			
Domestic HW Heater	456		45.64
Building Miscellaneous			
Lights		1,473	5.03
Equipment		1,914	6.53
System Miscellaneous			
Fans		27,804	94.89
Plant Miscellaneous			
DRYER		1,100	3.75
Consumption Totals	1,206	43,306	
Unit Cost	$0.608	$0.060	
Dollar Cost	$733	$2,598	$3,331
Site Energy (MBTU)	120.6	147.8	268.4
Source Energy (MBTU)		0.0	0.0

ASEAM3 ECO Summary

ECO Description

GERBER VILLAGE 100 AREA WITH BASEMENT
INSULATE BASEMENT WALLS

ECO Comparison with Base Case

Energy Type	Units	Base Case	ECO Case	Savings	Percent Savings
Gas	Therms	1,229	1,206	23	1.9
Electricity	kWh	43,335	43,306	29	0.1
Gas	Dollars	747	733	14	1.9
Electricity	Dollars	2,600	2,598	2	0.1
Annual Totals	Dollars	3,347	3,331	16	0.5
Gas	MBTU	122.877	120.598	2.279	1.9
Electricity	MBTU	147.901	147.803	0.098	0.1
Annual Totals	MBTU	270.778	268.402	2.376	0.9

BLCC 4.0: COMPARATIVE ECONOMIC ANALYSIS

BASE CASE: GV WITH BSMT
ALTERNATIVE: GV WITH BSMT

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 20.00 YEARS (JAN 1994 THROUGH DEC 2013)
DISCOUNT RATE: 3.1% Real (exclusive of general inflation)
BASE CASE LCC FILE: GV1BBAS2.LCC
ALTERNATIVE LCC FILE: GBBSMTIN.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: GV WITH BSMT	ALTERNATIVE: GV WITH BSMT	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$482	-$482
SUBTOTAL	$0	$482	-$482
FUTURE COST ITEMS:			
ENERGY EXPENDITURES	$51,847	$51,578	$269
SUBTOTAL	$51,847	$51,578	$269
TOTAL P.V. LIFE-CYCLE COST	$51,847	$52,060	-$213

NET SAVINGS FROM ALTERNATIVE GV WITH BSMT COMPARED TO ALTERNATIVE GV WITH BSMT

Net Savings	=	P.V. of non-investment savings	$269
	-	Increased total investment	$482
		Net Savings:	-$213

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

SAVINGS-TO-INVESTMENT RATIO (SIR)
FOR ALTERNATIVE GV WITH BSMT COMPARED TO ALTERNATIVE GV WITH BSMT

$$SIR = \frac{\text{P.V. of non-investment savings}}{\text{Increased total investment}} = 0.56$$

ADJUSTED INTERNAL RATE OF RETURN (AIRR)
FOR ALTERNATIVE GV WITH BSMT COMPARED TO ALTERNATIVE GV WITH BSMT
(Reinvestment rate = 3.10%; Study period = 20 years)

AIRR = 0.13%

ESTIMATED YEARS TO PAYBACK

Simple Payback never reached during study period
Discounted Payback never reached during study period

ENERGY SAVINGS SUMMARY

Energy type	Units	---Annual Consumption--- Base Case	Alternative	Energy Savings
Electricity	kWh	43,335	43,306	29
Natural Gas	Therm	1,229	1,206	23

Analysis: Attic Fan Installation

*Based on River Village

FT. BELVOIR HOUSING ECO

BASIS OF ATTIC FAN ANALYSIS

A. ASSUMPTIONS

1. Maximum attic temperature in summer, without mechanical ventilation = 130 °F, room temperature = 75 °F
2. Maximum attic temperature in summer, with mechanical ventilation = 100 °F, room temperature = 75 °F
3. Attic fan power requirement = 40 watts
4. Attic fan will operate whenever ambient temperature ≥ 85 °F (for approximately 584 hours/year*)
5. Attic insulation U-value = 0.05 (R-19)
6. Calculations performed for RIVER VILLAGE 1600 AREA
7. Energy efficiency of air-conditioning system = 1.65 kW/ton
8. Use 600 full-load hours/year for energy consumption of air-conditioning system

B. Cooling Load Calculations

1. Heat gain without attic fan
   690 SF x 0.05 x (130-75) Btuh = 1,898 Btuh (≈0.158 ton)

2. Heat gain with attic fan
   690 SF x 0.05 x (100-75) Btuh = 863 Btuh (≈0.072 ton)

C. Energy Consumption Comparison

1. AC system without attic fan
   0.158 ton x 600 hrs/yr x 1.65 kW/ton = 156 kWh/yr

2. AC system with attic fan
   0.072 ton x 600 hrs/yr x 1.65 kW/ton = 71 kWh/yr

   Attic fan: 0.04 kW x 584 hrs/yr = 23 kWh/yr

   Total = 94 kWh/yr

D. Life Cycle Cost Analysis

See 'BLCC' printouts.

(*) Source: TM 5-785

BLCC 4.0: COMPARATIVE ECONOMIC ANALYSIS

BASE CASE: RV 1600 AREA
ALTERNATIVE: RV1600 ATFAN

PRINCIPAL STUDY PARAMETERS:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
STUDY PERIOD: 20.00 YEARS (JAN 1994 THROUGH DEC 2013)
DISCOUNT RATE: 4.0% Real (exclusive of general inflation)
BASE CASE LCC FILE: RV1600.LCC
ALTERNATIVE LCC FILE: RV16AFAN.LCC

COMPARISON OF PRESENT-VALUE COSTS

	BASE CASE: RV 1600 AREA	ALTERNATIVE: RV1600 ATFAN	SAVINGS FROM ALT.
INITIAL INVESTMENT ITEM(S):			
CASH REQUIREMENTS AS OF SERVICE DATE	$0	$337	-$33
SUBTOTAL	$0	$337	-$33
FUTURE COST ITEMS:			
ANNUAL AND NON-AN. RECURRING COSTS	$0	$63	-$6
ENERGY EXPENDITURES	$129	$78	$5
SUBTOTAL	$129	$140	-$1
TOTAL P.V. LIFE-CYCLE COST	$129	$477	-$34

NET SAVINGS FROM ALTERNATIVE RV1600 ATFAN COMPARED TO ALTERNATIVE RV 1600 ARE

Net Savings	=	P.V. of non-investment savings	-$11
	-	Increased total investment	$337
		Net Savings:	-$348

Note: the SIR and AIRR computations include differential initial costs, capital replacement costs, and resale value (if any) as investment costs, per NIST Handbook 135 (Federal and MILCON analyses only).

Can't compute meaningful SIR and AIRR for the Alternative Case because its incremental investment is positive and total savings are negative. This project alternative IS NOT cost effective.

ESTIMATED YEARS TO PAYBACK

Simple Payback never reached during study period
Discounted Payback never reached during study period

ENERGY SAVINGS SUMMARY

Energy type	Units	---Annual Consumption--- Base Case	Alternative	Energy Savings
Electricity	kWh	156	94	62

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**********************************************************************
*        N I S T   B L C C 4.0   I N P U T   D A T A   L I S T I N G  *
**********************************************************************
```

FILE NAME: RV1600
FILE LAST MODIFIED ON 02-15-1994/11:11:33
PROJECT ALTERNATIVE: RV 1600 AREA
COMMENT: RIVER VILLAGE 1600 AREA: NO ATTIC VENTILATION

GENERAL DATA:

ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1994
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE: JAN 1994
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE: 4.0%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:

INITIAL COST (BASE YEAR $)	0
EXPECTED ASSET LIFE (YRS/MTHS)	20/0
RESALE VALUE FACTOR	0.00%
NUMBER OF REPLACEMENTS	0

NO REPLACEMENTS

OPERATING, MAINTENANCE, AND REPAIR COST DATA:

ANNUAL RECUR OM&R COST ($): 0

No non-annually-recurring OM&R costs reported.

ENERGY COST DATA:

NUMBER OF ENERGY TYPES = 1
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Residential
Underlying gen. inflation rate used with DOE rates: 0.00%

	TYPE 1
ENERGY TYPE:	Electricity
BASE ANNUAL CONSUMPTION:	156
UNITS:	kWh
PRICE PER UNIT ($):	0.060
ANNUAL DEMAND CHARGE ($):	0.00
ESCALATION RATE METHOD:	DOE rates

1994	-0.04
1995	0.11
1996	0.11
1997	-0.60
1998	-0.62
1999	1.05
2000	0.87
2001	0.35

2002	0.53
2003	0.59
2004	0.35
2005	-0.06
2006	-0.09
2007	0.04
2008	0.00
2009	-0.02
2010	0.15
2011	0.24
2012	0.24
2013	0.24

```
************************************************************************
*        N I S T  B L C C 4.0  I N P U T  D A T A  L I S T I N G       *
************************************************************************

FILE NAME: RV16AFAN
FILE LAST MODIFIED ON 02-15-1994/11:09:57
PROJECT ALTERNATIVE: RV1600 ATFAN
COMMENT: RIVER VILLAGE 1600 AREA: INSTALL ATTIC FAN

GENERAL DATA:
-------------
ANALYSIS TYPE: Federal Analysis--Energy Conservation Projects
BASE DATE FOR LCC ANALYSIS: JAN 1994
STUDY PERIOD: 20 YEARS, 0 MONTHS
SERVICE DATE:   JAN 1994
DISCOUNT AND INTEREST RATES ARE Real (exclusive of general inflation)
DISCOUNT RATE:  4.0%
Escalation rates do not include general inflation

CAPITAL ASSET COST DATA:
------------------------
INITIAL COST (BASE YEAR $)              337
EXPECTED ASSET LIFE (YRS/MTHS)          20/0
RESALE VALUE FACTOR                     0.00%
NUMBER OF REPLACEMENTS                     0

NO REPLACEMENTS


OPERATING, MAINTENANCE, AND REPAIR COST DATA:
---------------------------------------------
ANNUAL RECUR OM&R COST ($):       0

NON-AN RECURRING OM&R COSTS (YRS/MTHS FROM SERVICE DATE; COST IN BASE YEAR $):
 Y/M   COST
 5/0     25
10/0     25
15/0     25
20/0     25

ENERGY COST DATA:
-----------------
NUMBER OF ENERGY TYPES = 1
DOE energy price escalation rates filename: ENCOST94
DOE region (state code): 3 (VA)
DOE rate schedule type: Residential
Underlying gen. inflation rate used with DOE rates:  0.00%

                                 TYPE 1
ENERGY TYPE:                 Electricity
BASE ANNUAL CONSUMPTION:            94
UNITS:                             kWh
PRICE PER UNIT ($):               0.060
ANNUAL DEMAND CHARGE ($):         0.00
ESCALATION RATE METHOD:         DOE rates

                    1994          -0.04
                    1995           0.11
                    1996           0.11
```

1997	-0.60
1998	-0.62
1999	1.05
2000	0.87
2001	0.35
2002	0.53
2003	0.59
2004	0.35
2005	-0.06
2006	-0.09
2007	0.04
2008	0.00
2009	-0.02
2010	0.15
2011	0.24
2012	0.24
2013	0.24

Appendix H

Cost Data

- History of Utility Costs
- Estimated Costs for ECOs

'HISTORY OF UTILITY COSTS'
(FOR 'LIFE CYCLE COST ANALYSIS' AND 'ECIP')

Technical Note No. 420-41-1(Revision 1)
21 January 1992

SALES RATE SUMMARY

Installation: FORT BELVOIR

Date: 10/1/93

	Current Rates for FY 94			Current Rates for FY ____		
	A	H	B	A	H	B
Electric ($/KWh)	.0616		.0685			
Water ($/KGal)	1.3589		2.4602			
Sewage ($/KGal)	2.4160		3.8632			
Nat Gas ($/Therm) Firm	.5637		.5955			
Interruptible		N/A			N/A	
Refuse ($/CuYd)	3.3708		3.5432			
LP Gas ($/Gal)	.7700		.7931			
#2 Fuel Oil ($/Gal)	.7842		.8951			
Steam ($/KLb)	7.9845		10.2064			
Space Htg ($/SF/Mo)						
Space Htg ($/MCF)						
Space Htg ($/MBTU)						
Space Htg ($/Ton) Using Coal						
Space Htg ($/Ton) Using Wood Pellet						

The monthly Fuel Adjustment is added to Base Rates.

A = Rate A B = Rate B H = Family Housing Rate from 'Family Housing Rates' Sheet.

Prepared by: Michael G. Smith

Einhorn Yaffee Prescott
ARCHITECTURE & ENGINEERING, P.C

Estimate Sheet

Project Name FT. BELVOIR FAMILY HOUSING INSUL/ECO STUDY
CONTRACT Project No. DACA31-92-D-0061 DELIVERY ORDER NO. 0005
EYP NO. 60592.00 Date
Checked by Date

Div.	Description	Quantity	Unit	Unit Cost Labor	Unit Cost Material	Total Labor	Total Material	Total
A.	INSULATION FOR ABOVE GRADE EXTERIOR WALLS							
1	BLOWN-IN INSULATION							
	(3" CAVITY)	1	SF					1.50
2	REFINISH DRYWALL	1	SF					0.75
	SUBTOTAL							2.25
	10% CONTINGENCY							0.23
	TOTAL							$2.48
B.	INSULATION FOR ABOVE GRADE EXTERIOR WALLS							
1.	BLOWN-IN INSULATION							
	(1" CAVITY)	1	SF					1.10
2	REFINISHING DRYWALL	1	SF					0.65
	SUBTOTAL							1.75
	10% CONTINGENCY							0.18
	TOTAL							$1.93
C.	INSULATION FOR BASEMENT WALLS							
1.	R-19 BATT INSULATION	1	SF					1.50
	(INCL. STUDS)							
	10% CONTINGENCY							0.15
	TOTAL							$1.65

"The costs noted above are estimates only and may be modified by changing conditions and the passage of time."

Einhorn Yaffee Prescott
ARCHITECTURE & ENGINEERING, P.C

Estimate Sheet

Project Name FT. BELVOIR FAMILY HOUSING INSUL/ECO STUD
CONTRACT Project No. DACA31-92-D-0061 DELIVERY ORDER NO. 0005
EYP NO. 60592.00 Date
Checked by Date

Div.	Description	Quantity	Unit	Unit Cost Labor	Unit Cost Material	Total Labor	Total Material	Total
D.	INSULATION FOR CRAWL							
	SPACE							
1.	R-19 FIBERGLASS BATTS							
	(BETWEEN FLOOR JOISTS)	1	SF					0.60
	25% CONTINGENCY (*)							0.15
	TOTAL							# 0.75
	(*) TO ACCOUNT FOR LOW							
	CLEARANCE AT SOME UNITS							
E.	INSULATE WATER HEATER							
1.	2" BATT INSULATION	20	SF	1.50	0.36			37.20
	10% CONTINGENCY							3.72
	TOTAL							40.92
								USE $42.00
F.	INSTALL FLUORESCENT							
	LIGHT FIXTURES (TO							
	REPLACE EXIST. INCANDES-							
	CENT TYPE)							
1.	1-32W (48"L) FIXTURE,							
	SURFACE-MOUNTED (*)			40	55			95.00
	10% CONTINGENCY							10.00
								$105.00
	(*) ALTERNATIVE: 2-20W							
	(24"L) FIXTURE							

"The costs noted above are estimates only and may be modified by changing conditions and the passage of time."

Einhorn Yaffee Prescott
ARCHITECTURE & ENGINEERING PC

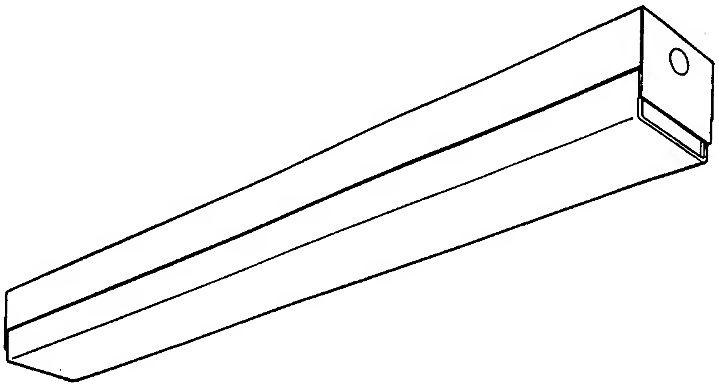
Estimate Sheet

Project Name FT. BELVOIR FAMILY HOUSING INSUL/ECO STUDY
CONTRACT Project No DACA31-92-D-0061 DELIVERY ORDER NO. 0005
EYP NO. 60592.00 Date
Checked by Date

Div	Description	Quantity	Unit	Unit Cost Labor	Unit Cost Material	Total Labor	Total Material	Total
G.	REACTIVATE EXISTING							
	WHOLE HOUSE FAN -							
	REPLACE CONTROLS							
1.	VAR. SPEED FAN SWITCH	1	EA		45			45.00
2.	CONTROL COMPONENTS	1	LS		30			30.00
3.	INSTALLATION	1	LS	80	10			90.00
	SUBTOTAL							165.00
	10% CONTINGENCY							16.50
	TOTAL							$181.50(*)
	(*) FOR 'ECIP' PROJECTS,							
	ADD $100.00 PER HOUSE							
	FOR POSSIBLE REPLACEMENT							
	OF EXIST. T'STATS/MOTORS						⟹	$282.00
H.	INSTALL NEW WHOLE							
	HOUSE FAN							
1.	WHOLE HOUSE FAN W/							
	SHUTTER & SPEED CONTROL							
	(CONTRACTOR'S QUOTE)	1	LS					655.00
2.	ELECTRICAL CONNECTION	1	LS					50.00
3.	PATCHING & FINISHING	1	LS					45.00
	SUBTOTAL							750.00
	10% CONTINGENCY							75.00
	TOTAL							$825.00

"The costs noted above are estimates only and may be modified by changing conditions and the passage of time."

CORRIDOR LIGHT
4' LENGTH • 1 LAMP • RAPID START | CA 140



Also available in 2', 3' and tandem-wired (8') lengths.

- Slim, low-profile housing - diffuser assembly hinges or latches from either side on four steel torsion springs.
- Prismatic acrylic diffuser standard - flat white opal acrylic or high-impact version optional.
- Diffuser ends injection-molded to match diffuser.
- End plates welded to channel for clean, finished appearance.
- Channel cover secured by quarter-turn fasteners for easy access

SPECIFICATIONS

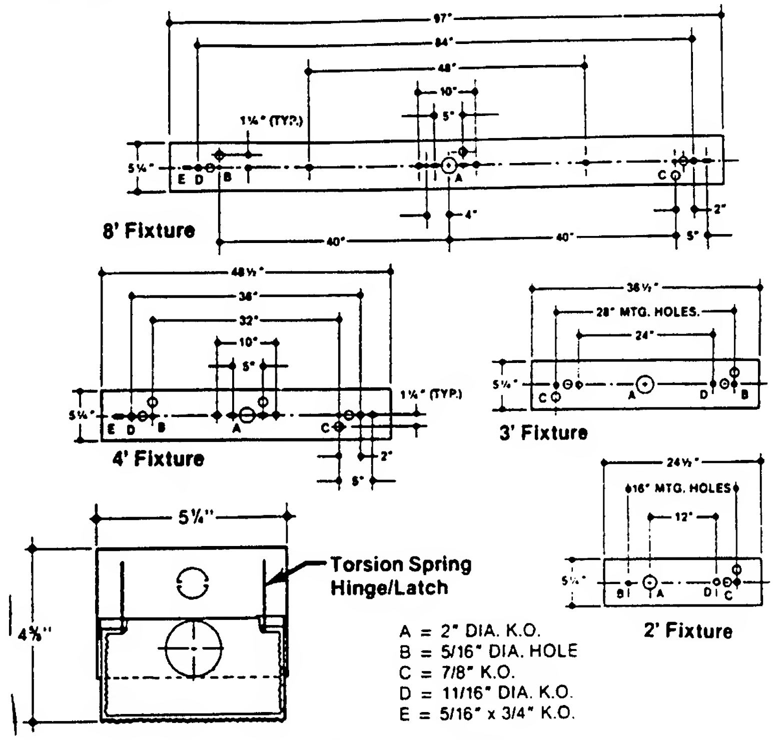
Ballast Data
Thermally-protected, resetting, Class P, HPF, non-PCB, UL listed, ballast standard. Sound rating A. Standard combinations are CBM approved and meet all federal guidelines for ballast efficacy.

Wiring & Electrical
Fixture bears UL label and is suitable for damp locations. AWM, TFN or THHN wire used throughout, rated for required temperatures. Channel has 2" K.O. and 7/8" K.O. for wiring access.

Materials
Metal parts die-formed from code-gauge steel. Diffuser is acrylic. No asbestos is used in this product.

Finish
Five-stage iron-phosphate pre-treatment ensures superior paint adhesion and rust resistance. Painted parts finished with high-gloss, baked white enamel.

Input Wattage
CA 140 with energy-saving ballasts, standard lamps: 42W
CA 140 with energy-saving ballasts and lamps: 36W

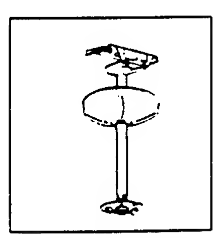


UL listed & labeled I.B.E.W. - A.F. of L. Guaranteed for 1 year against mechanical defects in manufacture. Dimensions & specifications subject to change without notice.

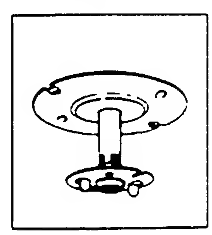
MOUNTING DATA

For unit or row installation, surface or stem mounting.

Two hanging devices per fixture required.



SWIVEL STEM HANGER



CEILING SPACER

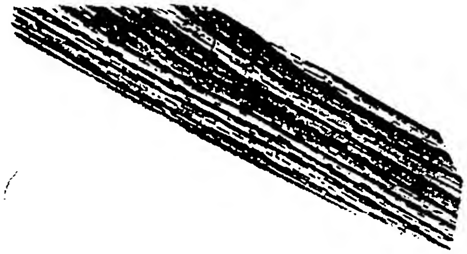
Approval

Job Information

Type__________
(Specify 120V, 277V)

LITHONIA FLUORESCENT
COMMERCIAL & INDUSTRIAL LIGHTING

Sheet CA 140

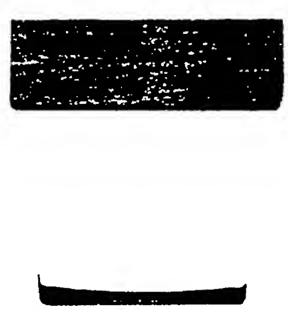


TRADITIONAL WRAPAROUNDS

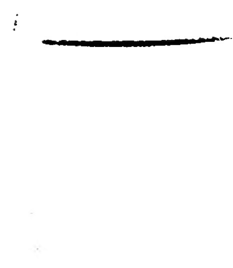
Classic decorative wraparounds with prismatic acrylic diffuser. Available with solid wood ends or metal ends finished in Walnut, Country Oak or White.

10607

10601



10610



10623

	2-20W	2-40W	4-40W
	10" × 24" × 3"	10" × 48" × 3"	15⅜" × 48" × 3"
Walnut	10601	10602	10603
Country Oak	10605	10606	10607
White	10621	10623	10625
	10¼" × 25½" × 3⅜"	10¼" × 49½" × 3⅜"	15½" × 49½" × 3⅜"
Solid Wood Ends	10610	10611	10612

(SOURCE: 'LITHONIA') H-6

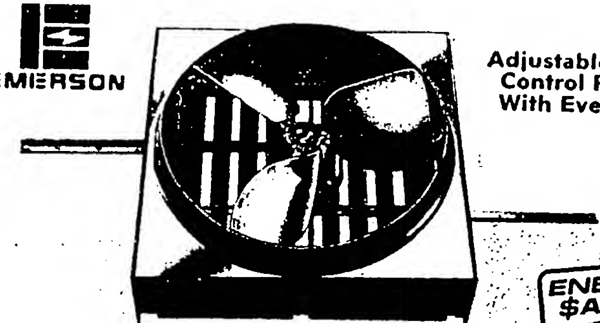
Blade Dia	HP	Spd	CFM Air Delivery Free Air	0.10" SP	Fan RPM	@115V, 60 Hz Watts	Amps	Dimen Sq	H	Recommended Ceiling Shutter No.	Stock No.	List	Each	Shpg. Wt.
30"	1/3	H L	7550 5100	6500 4400	485 323	560 250	7.5 3.5	34"	21⅛"	4C225 or 3C514	3C325	$522.70	$326.60	89.0
36	1/2	H L	10860 7350	8850 3230	440 300	740 350	9.2 6.0	40	20¼	4C228, 3C512, or 3C515	3C692	645.90	403.65	100.0

18-gauge steel venturi panel has welded tubular steel supports with gray enamel finish. Heavy-duty 6-wing steel fan blade has red enamel finish.

Unit comes with 1 x 6" wooden plenum and 3/4 x 7/16" adhesive-backed sponge rubber mounting strip for quiet operation. Includes 2-speed switch and 12-hour timer. Shutter not included. **NOTE:** When selecting shutter, be sure that its overall dimensions will fit into the available space. UL Listed. Dayton brand.

24 AND 30" WHOLE HOUSE FANS

EMERSON



Adjustable Speed Control Packed With Every Fan

PARTS AVAILABLE, CALL 1-800-323-0620

- **Adjustable speed control and shutter included**
- **No attic joists to cut, no frame to build**
- **Includes heavy gauge polymeric plenum. Simply snaps onto fan housing, minimizes air leakage for improved efficiency**
- **Powerful 1/3 HP ball bearing motor. Never needs oiling. Overload protected**
- **Triple isolated: blades, fan, and motor rubber isolated for quiet operation**

Removes hot, humid air from home living areas and draws in cooler outside air. Operates at a fraction of the cost of central air conditioning.

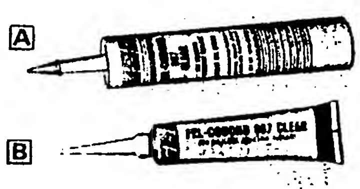
Emerson direct drive, 1/3 HP motor reduces power consumption by eliminating drive belts. Adjustable speed motor control included. Rubber isolation absorbers mounted between motor and fan frame, and between blade and motor shaft. Specially designed flush-mounted automatic white shutter included. Fan and shutter are packaged together. UL Listed. Emerson brand.

Blade Dia	CFM Air Del Free Air	0.10" SP	Fan RPM	Watts (@Max. RPM 120V, 60Hz)	Amps	Dimensions Square	H	Emerson Model	Stock No.	List	Each	Shpg. Wt.
24"	4400	3600	660	584	5.8	29"	14"	WH24FM	3C569	$314.95	$226.90	32.0
30	6300	5100	510	575	5.9	34	14	WH30FM	3C535	339.95	247.75	35.0

Emerson whole house ventilating fans. The ratings shown are results from tests at 0.10" Static Pressure with recommended ceiling shutter mounted minimum 6" from fan.

OPTIONAL 12-HOUR TIMER. Automatically shuts off fan at pre-selected time interval. 120V, 60 Hz. No. 6X547. Shpg. wt. 0.4 lbs. List $25.70. Each. $15.82

RTV SILICONE ADHESIVE/SEALANTS



Silicone adhesive/sealants are used for sealing, bonding, caulking, waterproofing, and insulating.

Cures without shrinkage. Seals against oil, water, and antifreeze.

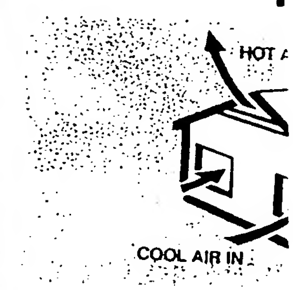
For use in temperature range from −85 to +450° F. Comes in an 11-oz cartridge and 3-oz metal tube. Fel-Pro brand.

Key	Descriptions	Container Size	Type	Fel-Pro Model	Stock No.	List	Each	Shpg. Wt.
A	RTV Silicone Adhesive/Sealant	11 oz	Cartridge	51298	2A266	$9.31	$8.66	0.9
B	RTV Silicone Adhesive/Sealant	3 oz	Metal Tube	51295	2A267	4.27	3.96	0.3

3-Sp Control With Ev

Blade Dia	Speed	Free Air C
24"	High Med. Low	4[illegible] 3[illegible] 2[illegible]
30	High Med. Low	65 54 45
36	High Med. Low	85 69 61

Fasco b recomm All HVI



Calculate the total g multiply by three. Be multilevel homes. Sel equal or greater CFM

A two speed motor a quickly on high speed lower speed (with less lower speed also perm

It is recommended that area be provided for ea Louvers with insect o

SEE

BENFIELD ELECTRIC CO. OF VIRGINIA, INC.

ELECTRICAL CONTRACTORS
P.O. BOX 189 • LORTON, VIRGINIA 22079 • 550-7081 • (FAX) 550-8049

June 14, 1994

Einhorn Yaffee Prescott
1000 Potomac Street
Washington D.C. 20007
(202) 471-5025

ATTN: Frank Ebbert

Mr. Ebbert:

We are pleased to submit our quotation to furnish & install one hundred fifty (150) 30" belt driven whole house fans with variable speed control & 12 hour mechanical timers.

1. Fan - Type Fasco 3038
2. Shutter - Type Fasco 3024
3. Speed Controller - Type Fasco 558
4. 12 Hour Mechanical Timer - Type Fasco 1012

Specifications:

1. Existing attics are accessible.
2. Power is to be readily available.
3. Hallways are minimum of 36" wide.
4. Ceilings are drywall.
5. Patching & painting, if any, by others.
6. Assumed existing attic exhaust area is 7.3 square foot minimum.
7. Electrical permit is not included.
8. One year warranty on parts & labor.
9. Five year warranty on fan motor.

FOR THE PRICE OF ------------------------ $ 656.00 per fan*

**This price is based upon the installation of 150 fans or more and is valid for 30 days.*

Thank you for your consideration and if you should have any questions, concerns or should require further pricing please feel free to call.

Sincerely yours,
BENFIELD ELECTRIC CO. OF VIRGINIA, INC.

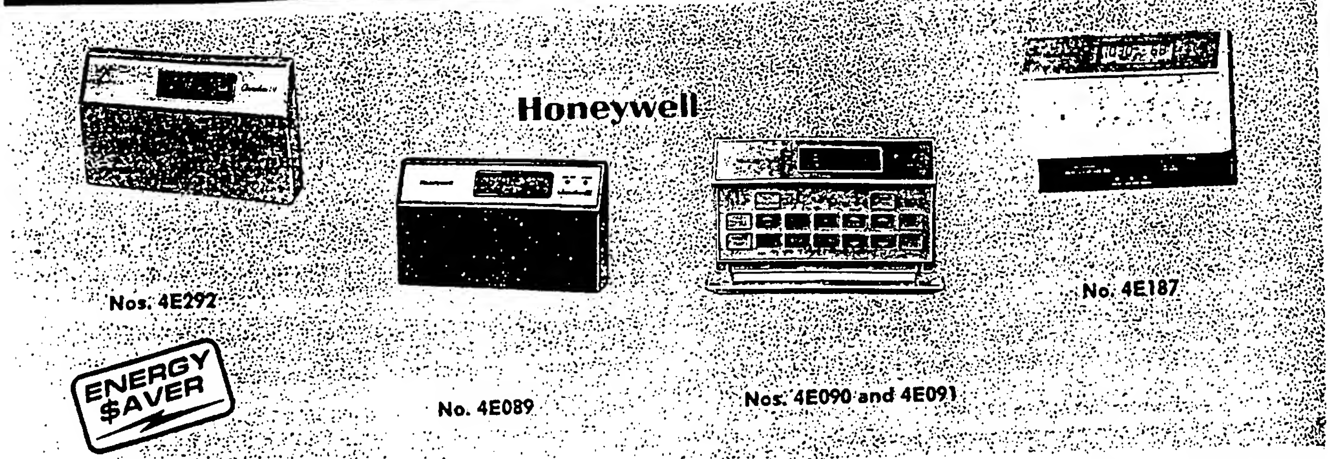
James Tharp

James Tharp, Project Manager

JT/cd

* COST OF INSTALLATION QUOTED BY CONTRACTORS ~ $60.00

HONEYWELL PROGRAMMABLE MICROELECTRONIC THERMOSTATS



Nos. 4E292 — No. 4E089 — Nos. 4E090 and 4E091 — No. 4E187

- **Low voltage (15 to 30VAC) thermostats**
- **Automatically raise or lower temperature at preselected times**
- **All models feature offset periods, program change function, offset mode indicator and adjustable heat anticipation/cycling rates. Solid state.**
- **Can save 9 to 30% on heating costs; can cut cooling costs 7 to 25%. Some states offer additional credits for use of these energy saving devices**
- **Battery backup on Nos. 4E089, 4E090, 4E091 and 4E187 maintains a preprogrammed heat or cool setting if power fails**
- **Setting range: 45 to 88°F**
- **All units factory programmed**
- **Wall plate included**

Provide automatic control of single stage heating or heating/cooling systems. Nos. 4E187 and 4E091 have automatic changeover. All models except No. 4E292 are powered through the heating/cooling system controls and have "ENR. SAV." and "System" light-emitting diodes (LED).

Four different temperature settings per daily schedule to optimize user comfort and energy savings.

Different daily schedules may be selected for weekdays, Saturday, and Sunday (5-1-1 programming). No. 4E187 is 7-day programming; everyday can be programmed separately.

AAA batteries (included) provide backup power to clock and memory during power failures for Nos. 4E089, 4E090, 4E091 and 4E187. AA batteries provide main power source on No. 4E292.

Programming may be done before or after installation (batteries must be installed).

Manual program override by using "WARMER" or "COOLER" keys, "SKIP" next program key, "CHANGE" to last program key or "HOLD TEMPERATURE" key for indefinite program override (vacation/holiday).

Adaptive intelligent recovery function brings room temperature to programmed temperature at programmed time, maximizing comfort and energy savings.

LCD digital clock indicates continuous time-of-day, day-of-week, current period, and room temperature. Upon inquiry, provides program times and set points.

Finish: Matte beige cover; brushed metal faceplate.

Dimensions: 4¹⁄₁₆H x 7W x 1¾"D; No. 4E187: 5⁵⁄₁₆H x 7W x 1¾"D.

THERMOSTAT SPECIFICATIONS DATA

Type of Thermostat	Stock No.	Heat Pump	Dual Transformer	Changeover/ Damper Control	Temp. Settings 24 Hrs.	Max. Programs Per Week	Manual Override	LCD Program Review	Battery Back Up	Digital Clock	Electric Heat
Heating-Cooling	4E292	Yes	Yes	Yes	4	3	Yes	Yes	Yes	Yes	Yes
Heating-Cooling	4E089	Yes	No	Yes	4	3	Yes	Yes	Yes	Yes	No
Heating-Cooling	4E090	No	Yes	No	4	3	Yes	Yes	Yes	Yes	No
Heating-Cooling	4E091	No	Yes	No	4	3	Yes	Yes	Yes	Yes	No
Heating-Cooling	4E187	No	Yes	No	4	7	Yes	Yes	Yes	Yes	No

THERMOSTAT ORDERING DATA

Type of Thermostat	Stages Heat	Stages Cool	Switching System	Switching Fan	Honeywell Model	Stock No.	List	Each	Shpg. Wt.
Heating-Cooling	1	1	Heat-Off-Cool	On-Auto	T8602C1046	**4E292**	$244.48	**$131.40**	1.3
Heating-Cooling	1	1	Heat-Off-Cool	On-Auto	T8600C1006	**4E089**	242.00	**128.26**	1.4
Heating-Cooling	1	1	Heat-Off-Cool	On-Auto	T8600C1014	**4E090**	242.00	**128.26**	1.2
Heating-Cooling	1	1	Heat-Off-Cool-Auto	On-Auto	T8600D1004	**4E091**	283.50	**150.25**	1.4
Heating-Cooling	1	1	Heat-Off-Cool-Auto	On-Auto	T8621A7002	**4E187**	303.70	**163.26**	1.4

THERMOSTAT GUARD FOR HONEYWELL THERMOSTATS ABOVE

Thermostat Guard is a locking cover for Honeywell thermostats 4E089, 4E090, 4E091, 4E187, 4E188, and 4E292. Covers yet keeps visible time and temperature display, and programming keys. Maintains access to WARMER/COOLER keys. Displays LED lights on those thermostats which have LED lights. Beige plastic with removable metal faceplate; lock with key. 4⅞H x 1⅜W x 7⅛"D. Honeywell brand (TG586A1000).

No. 4E293. Thermostat Guard. Shpg. wt. 0.5 lbs. List $52.80
Each $27.92

Appendix I

ECIP Forms

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA REGION NO. 3 PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO) FISCAL YEAR 95
DISCRETE PORTION NAME: Gerber Village 100 Area - No Basement: Multiple ECO's ECIP No. 1
ANALYSIS DATE: Jan '95 ECONOMIC LIFE 20 PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 120,714		
B.	SIOH	$ 7,243		
C.	DESIGN COST	$ 7,243		
D.	TOTAL COST (1A+1B+1C)	$ 135,200		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 135,200

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994) DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	1,404	$ 24,682	15.61	$ 385,291
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	1,327	$ 8,066	20.96	$ 169,081
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		2,731	$ 32,748		$ 554,372

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4.	FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE)):	$ 32,748
5.	SIMPLE PAYBACK (1G/4):	5 YEARS
6.	TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C):	$ 554,372
7.	SAVINGS TO INVESTMENT RATIO (SIR) 6/1G:	3.72

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA   REGION NO. 3   PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO)   FISCAL YEAR 95
DISCRETE PORTION NAME: Gerber Village 10 0 Area - With Basement: Multiple ECO's   ECIP No. 2
ANALYSIS DATE: Jan '95   ECONOMIC LIFE 20   PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 168,480		
B.	SIOH	$ 10,109		
C.	DESIGN COST	$ 10,109		
D.	TOTAL COST (1A+1B+1C)	$ 188,698		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 188,698

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994)   DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	2,092	$ 36,775	15.61	$ 574,094
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	2,221	$ 13,501	20.96	$ 282,990
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		4,313	$ 50,276		$ 857,084

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4.	FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE)):	$ 50,276
5.	SIMPLE PAYBACK (1G/4):	4 YEARS
6.	TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C):	$ 857,084
7.	SAVINGS TO INVESTMENT RATIO (SIR) 6/1G:	4.37

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA REGION NO. 3 PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO) FISCAL YEAR 95
DISCRETE PORTION NAME: 166-171 Area: Multiple ECO's ECIP No. 3
ANALYSIS DATE: Jan '95 ECONOMIC LIFE 20 PREPARER EINHORN YAFFEE PRESCOTT

1.	INVESTMENT COSTS:			
A.	CONSTRUCTION COST	$ 51,276		
B.	SIOH	$ 3,076		
C.	DESIGN COST	$ 3,076		
D.	TOTAL COST (1A+1B+1C)	$ 57,429		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 57,429

2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994) DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	475	$ 8,354	15.61	$ 130,351
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	316	$ 1,922	20.96	$ 40,263
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		791	$ 10,176		$ 170,624

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4.	FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE)):	$ 10,176
5.	SIMPLE PAYBACK (1G/4):	6 YEARS
6.	TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C):	$ 170,624
7.	SAVINGS TO INVESTMENT RATIO (SIR) 6/1G:	2.67

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA REGION NO. 3 PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO) FISCAL YEAR 95
DISCRETE PORTION NAME: T-400 Area "T"-shape units: Multiple ECO's ECIP No. 4
ANALYSIS DATE: Jan '95 ECONOMIC LIFE 20 PREPARER EINHORN YAFFEE PRESCOTT

1.	INVESTMENT COSTS:			
A.	CONSTRUCTION COST	$ 29,804		
B.	SIOH	$ 1,788		
C.	DESIGN COST	$ 1,788		
D.	TOTAL COST (1A+1B+1C)	$ 33,380		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 33,380

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994) DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	421	$ 7,401	15.61	$ 115,532
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	175	$ 1,064	20.96	$ 22,298
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		596	$ 8,465		$ 137,830

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4.	FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE):	$ 8,465
5.	SIMPLE PAYBACK (1G/4):	4 YEARS
6.	TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C):	$ 137,830
7.	SAVINGS TO INVESTMENT RATIO (SIR) 6/1G:	3.76

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA   REGION NO. 3   PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO)   FISCAL YEAR 95
DISCRETE PORTION NAME: T-400 Area "L"-shape units: Multiple ECO's   ECIP No. 5
ANALYSIS DATE: Jan '95   ECONOMIC LIFE 20   PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 42,069		
B.	SIOH	$ 2,524		
C.	DESIGN COST	$ 2,524		
D.	TOTAL COST (1A+1B+1C)	$ 47,118		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 47,118

2. ENERGY SAVINGS (+)/COST(-):

DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994)   DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	560	$ 9,845	15.61	$ 153,677
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	672	$ 4,085	20.96	$ 85,623
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		1,232	$ 13,930		$ 239,300

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4. FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE): $ 13,930
5. SIMPLE PAYBACK (1G/4): 4 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C): $ 239,300
7. SAVINGS TO INVESTMENT RATIO (SIR) 6/1G: 4.57

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA   REGION NO. 3   PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO)   FISCAL YEAR 95
DISCRETE PORTION NAME: River Village 1600 Area: Replace 3 Light Fixtures with Fluorescent type   ECIP No. 6
ANALYSIS DATE: Jan '95   ECONOMIC LIFE 20   PREPARER EINHORN YAFFEE PRESCOTT

1. INVESTMENT COSTS:

A.	CONSTRUCTION COST	$ 59,220		
B.	SIOH	$ 3,553		
C.	DESIGN COST	$ 3,553		
D.	TOTAL COST (1A+1B+1C)	$ 66,326		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 66,326

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994)   DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	661	$ 11,620	15.61	$ 181,394
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	(-) 63	$ (-) 383	20.96	$ (-) 8,027
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		598	$ 11,280		$ 173,367

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4.	FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE):	$ 598
5.	SIMPLE PAYBACK (1G/4):	6 YEARS
6.	TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C):	$ 173,367
7.	SAVINGS TO INVESTMENT RATIO (SIR) 6/1G:	2.46

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Ft. Belvoir, VA   REGION NO. 3   PROJECT NO. DACA-31-92 D0061 Del. Order 5
PROJECT TITLE: Housing Insulation Study (ECO)   FISCAL YEAR 95
DISCRETE PORTION NAME: River Village 1600 Area: Install Whole House Fans & Prog. Thermostats   ECIP No. 7
ANALYSIS DATE: Jan '95   ECONOMIC LIFE 20   PREPARER EINHORN YAFFEE PRESCOTT

1.	INVESTMENT COSTS:			
A.	CONSTRUCTION COST	$ 213,003		
B.	SIOH	$ 12,780		
C.	DESIGN COST	$ 12,780		
D.	TOTAL COST (1A+1B+1C)	$ 238,564		
E.	SALVAGE VALUE OF EXISTING EQUIPMENT		$ -0-	
F.	PUBLIC UTILITY COMPANY REBATE		$ -0-	
G.	TOTAL INVESTMENT (1D-1E-1F)			$ 238,564

2. ENERGY SAVINGS (+)/COST(-):
DATE OF NISTIR -4942-1 USED FOR DISCOUNT FACTORS (BOD Oct 1994)   DISCOUNT RATE: 3.1%

ENERGY SOURCE	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 17.58	2,435	$ 42,807	15.61	$ 668,222
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$ 6.079	621	$ 3,775	20.96	$ 79,125
G. OTHER	$		$		$
H. DEMAND SAVINGS			$		$
I. TOTAL		3,056	$ 46,582		$ 747,347

3. NON-ENERGY SAVINGS (+) OR COST (-):

A.	ANNUAL RECURRING (+/-)	$		
(1)	DISCOUNT FACTOR (TABLE A)			
(2)	DISCOUNTED SAVINGS/COST (3A X 3A1)			$ 0

B. NON-RECURRING SAVINGS (+) OR COST (-)

ITEM	SAVINGS (+) COST (-) (1)	YEAR OF OCCUR. (2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS/ (+)COST(+/-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON -ENERGY DISCOUNTED SAVINGS (3A2+3B4d) $ 0

4.	FIRST YEAR DOLLAR SAVINGS (2I3+(3Bd1/YRS ECON LIFE):	$ 46,582
5.	SIMPLE PAYBACK (1G/4):	6 YEARS
6.	TOTAL NET DISCOUNTED SAVINGS (2I5 + 3C):	$ 747,347
7.	SAVINGS TO INVESTMENT RATIO (SIR) 6/1G:	2.84

Appendix J

- **Scope of Work**
- **ECIP Guidance**

SCOPE OF WORK
FOR A
LIMITED ENERGY STUDY

TABLE OF CONTENTS

1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:

~~1.1~~ Review the previouslv ... Engineering Analysis Program (EEAP) ... the specific building, system, or ene... opportunity (ECO) covered by this study. OMIT

1.2 Perform a limited site survey of specific buildings or areas to collect all data required to evaluate the specific ECOs included in this study.

~~1.3~~ Reevaluate the spec... ECO from the previous study to determi... ...ity based on revised criteria, current si... ...s and technical applicability. OMIT

1.4 Evaluate specific ECOs to determine their energy savings potential and economic feasibility.

1.5 Provide project documentation for recommended ECOs as detailed herein.

1.6 Prepare a comprehensive report to document all work performed, the results and all recommendations.

2. GENERAL

2.1 This study is limited to the evaluation of the specific buildings, systems, or ECOs listed in Annex A, DETAILED SCOPE OF WORK.

2.2 The information and analysis outlined herein are considered to be minimum requirements for adequate performance of this study.

~~2.3~~ For the buildings, system... ECOs listed in Annex A, all methods of energy conservation ...e reasonable and practical shall be considered, inclu... ...ovements of operational methods and procedures as well ... physical facilities. All energy conservation opportun... ...ch produce energy or dollar savings shall be docum... ...this report. Any energy conservation opportunity consider... ...nfeasible shall also be documented in the report with reasons for elimination. OMIT

~~2.4~~ The study ... use of all energy sources applicable to each ... system, or ECO. OMIT

2.5 The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from CEHSC-FU, dated 4 Nov 1992 and the latest revision from CEHSC-FU establishes criteria for ECIP projects and shall be used for performing the economic analyses of all ECOs and projects. The program, Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. If any program other than LCCID is proposed for life cycle cost analysis, it must use the mode

of calculation specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval to the Contracting Officer.

2.6 Computer modeling will be used to determine the energy savings of ECOs which would replace or significantly change an existing heating, ventilating, and air-conditioning (HVAC) system. The requirement to use computer modeling applies only to heated and air-conditioned or air-conditioned-only buildings which exceed 8,000 square feet or heated-only buildings in excess of 20,000 square feet. Modeling will be done using a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The program will use established weather data files and may perform calculations on a true hour-by-hour basis or may condense the weather files and the number of calculations into several "typical" days per month. The Detailed Scope of Work, Annex A, will list programs that are acceptable to the Contracting Officer. If the AE desires to use a different program, it must be submitted for approval with a sample run, an explanation of all input and output data, and a summary of program methodology and energy evaluation capabilities.

2.7 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This will involve combining similar ECOs into larger packages which will qualify for ECIP, ~~[illegible]~~ funding, and determining in coordination with installation personnel the appropriate packaging and implementation approach for all feasible ECOs.

2.7.1 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings to Investment Ratio (SIR).

2.7.2 All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.

2.7.3 At some installations Energy Conservation and Management (ECAM) funding will be used instead of ECIP funding. The criteria for each program is the same. The Director of Engineering and Housing will indicate which program is used at this installation. This Scope of Work mentions only ECIP, however, ECAM is also meant.

3. <u>PROJECT MANAGEMENT</u>

3.1 <u>Project Managers</u>. The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be

responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract. This individual will be the Government's representative.

Mr. Mike Stambaugh, Energy Conservation Coordinator, (703) 806-4[illegible]

3.2 Installation Assistance. The Commanding Officer or authorized representative at the installation will designate an individual to assist the AE in obtaining information and establishing contacts necessary to accomplish the work required under this contract. This individual will be the installation representative.

3.3 Public Disclosures. The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

3.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE's project manager and the Government's representative shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.

3.5 Site Visits, Inspections, and Investigations. The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

3.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.

3.7 Interviews. The AE and the Government's representative shall conduct entry and exit interviews with the Director of Engineering and Housing before starting work at the installation

and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance.

3.7.1 Entry. The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:

a. Schedules.

b. Names of energy analysts who will be conducting the site survey.

c. Proposed working hours.

d. Support requirements from the Director of Engineering and Housing.

3.7.2 Exit. The exit interview shall briefly describe the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from the Director of Engineering and Housing.

4. SERVICES AND MATERIALS. All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, supervision and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

5. PROJECT DOCUMENTATION. All energy conservation opportunities which the AE has considered shall be included in one of the following categories and presented in the report as such:

5.1 ECIP Projects. To qualify as an ECIP project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than $300,000, a Savings to Investment Ratio greater than one and a simple payback period of less than ten years. For ECAM projects, the $300,000 limitation may not apply; in such cases, the AE shall check with the installation for guidance. The overall project and each discrete part of the project shall have an SIR greater than one. All projects meeting the above criteria shall be arranged as specified in paragraph 2.7.1 and shall be provided with programming documentation. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure (PDB). A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO are combined. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. [For projects and ECOs reevaluated from previous studies, the backup data shall consist of copies of the original calculations and analysis, with new pages revising the original calculations and analysis. In addition, the backup data shall include as much of the following as is available: the increment

of work under which the project or ECO was developed in the previous study, title(s) of the project(s), the energy to cost (E/C) ratio, the benefit to cost (B/C) ratio, the current working estimate (CWE), and the payback period. The purpose of this information is to provide a means to prevent duplication of projects in any future reports.]

5.2 Non-ECIP Projects. Projects which do not meet ECIP criteria with regard to cost estimate or payback period, but which have an SIR greater than one shall be documented. Projects or ECOs in this category shall be arranged as specified in paragraph 2.7.2 and shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, ie, energy savings calculations and cost estimate(s), and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:

a. Quick Return on Investment Program (QRIP). This program is for projects which have a total cost greater than $3,000 but less than $100,000 and a simple payback period of two years or less.

b. Productivity Enhancing Capital Investment Program (PECIP). This program is for projects which have a total cost of greater than $3,000 but lees than $100,000 and a simple payback period of four years or less.

c. OSD Productivity Investment Funding (OSD PIF). This program is for projects which have a total cost of more than $100,000 and a simple payback period of four years or less.

The above programs and the required documentation forms are all described in detail in AR 5-4, Change No. 1.

d. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than $300,000 and a simple payback period of four to twenty-five years. Documentation shall consist of DD Form 1391 and a Project Development Brochure.

e. Low Cost/No Cost Projects. These are projects which the Director of Engineering and Housing (DEH) can perform using his resources. Documentation shall be as required by the DEH.

f. These projects shall be combined for ECIP funding

5.3 Nonfeasible ECOs. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.

6. DETAILED SCOPE OF WORK. The Detailed Scope of Work is contained in Annex A.

7. WORK TO BE ACCOMPLISHED.

~~7.1~~ Review Previous Studi- ew the previous EEAP study which applies to the spe- ...ing, system, or ECO covered by this study. This re- ... acquaint the AE with the work that has been perfor- OMIT ...sly. Much of the information the AE may need to devel- ...COs in this study may be contained in the previous stud...

7.2 Perform a Limited Site Survey. The AE shall obtain all necessary data to evaluate the ECOs or projects by conducting a site survey. However, the AE is encouraged to use any data that may have been documented in a previous study. The AE shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrated prior to its use.

~~7.3~~ Reevaluate Selected Projects. The AE shall reevaluate the projects and ECOs listed in Annex A. ...ese are projects and ECOs that the previous study has ide- ... but that have not been accomplished or only parts have ... ...mplished. If the project or ECO is acceptable as is, ... there are no changes to the basic project or ECO, th- ... savings shown in the previous project may be accep- OMIT ...curate but the energy cost and construction cost e- ... shall be updated based on the most current data availa- ... With the above information the project shall then be analyzed based on current ECIP criteria. If the project or ECO is basically acceptable but some of the buildings in the original project have been deleted or new buildings can be added, the necessary changes shall be made to the energy savings, the energy costs and construction costs shall be updated, and the revised project or ECO shall then be analyzed using current ECIP guidance. If the original project or ECO has had numerous changes made to it so that all of the numbers are suspected of being inaccurate, but the project or ECO is still considered feasible, the AE shall develop the project from the beginning and analyze it with the current ECIP guidance. These projects shall be separately listed in the report.

7.4 Evaluate Selected ECOs. The AE shall analyze the ECOs listed in Annex A. These ECOs shall be analyzed in detail to determine their feasibility. Savings to Investment Ratios (SIRs) shall be determined using current ECIP guidance. The AE shall provide all data and calculations needed to support the recommended ECO. All assumptions and engineering equations shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. A life cycle cost analysis summary sheet shall be prepared for each ECO and included as part of the supporting data.

7.5 Combine ECOs Into Recommended Projects. During the Interim Review Conference, as outlined in paragraph [7.6.1], the AE will be advised of the DEH's preferred packaging of recommended ECOs into projects for implementation. Some projects may be a combination of several ECOs, and others may contain only one. These projects will be evaluated and arranged as outlined in paragraphs 5.1, 5.2, and 5.3. Energy savings calculations shall take into account the synergistic effects of multiple ECOs within a project and the effects of one project upon another. The results of this effort will be reported in the Final Submittal per par [7.6.2].

7.6 Submittals, Presentations and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and shall be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. Names of the persons primarily responsible for the project shall be included. The AE shall give a formal presentation of the interim submittal to installation, command, and other Government personnel. Slides or view graphs showing the results of the study to date shall be used during the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. It is anticipated that the presentation and review conference will require approximately one working day. The presentation and review conference will be at the installation on the date agreeable to the Director of Engineering and Housing, the AE and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.

7.6.1 Interim Submittal. An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings, SIR, and simple payback period of all the ECOs shall be included. The results of the ECO analyses shall be summarized by lists as follows:

a.All ECOs eliminated from consideration shall be grouped into one listing with reasons for their elimination as discussed in par 5.3.

b.All ECOs which were analysed shall be grouped into two listings, recommended and non-recommended, each arranged in order of descending SIR. These lists may be subdivided by building or area as appropriate for the study.

The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. At the Interim Submittal and Review Conference, the Government's and AE's representatives shall coordinate with the Director of Engineering and Housing to provide the AE with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

7.6.2 Final Submittal. The AE shall prepare and submit the final report when all sections of the report are 100% complete and all comments from the interim submittal have been resolved. The AE shall submit the Scope of Work for the study and any modifications to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The recommended projects, as determined in accordance with paragraph 5, shall be presented in order of priority by SIR. The lists of ECOs specified in paragraph [7.6.1] shall also be included for continuity. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The final report shall be arranged to include:

a. An Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex B for minimum requirements).

b. The narrative report describing the problem to be studied, the approach to be used, and the results of this study.

c. Documentation for the recommended projects (includes LCCA Summary Sheets).

d. Appendices to include as a minimum:

1) Energy cost development and backup data

2) Detailed calculations

3) Cost estimates

4) Computer printouts (where applicable)

5) Scope of Work

DRAFT

Annex A

MAY 26 1993

FAMILY HOUSING INSULATION STUDY

SCOPE OF WORK

1. Purpose. Specific Energy Conservation Opportunities (ECOs) to tighten the building envelope will be analyzed against existing conditions using Energy Conservation Investment Program (ECIP) criteria.

2. Buildings to be Evaluated. The study population consists of six different family housing models. Floor plans will be provided by the Installation. The specific units will be selected based on occupancy status at the time of study commencement. The different model types are as follows:

a. Gerber Village, 100 Area, 2 Story, 4 Bedroom House with Basement;

b. Gerber Village, 100 Area, 2 Story, 4 Bedroom House without Basement;

c. 166-171 Area, 3 Story, 3 Bedroom Townhouse;

d. 400 Area, 1 Story, 3 Bedroom House, 'T' Shape;

e. 400 Area, 1 Story, 4 Bedroom House, 'L' Shape;

f. River Village, 1600 Area, 2 Story, Three Bedroom Townhouse.

3. Building Audits. The Architect-Engineer (AE) shall audit the building envelop and heat/loss characteristics of the housing units listed above. All characteristics of the housing units that are relevant to evaluating the energy conservation opportunities, listed below, will be a part of the audit.

4. Energy Conservation Opportunities (ECOs).

a. Weatherstripping/Caulking. The AE shall evaluate the cost/benefit of improving the weatherstripping/caulking where appropriate (e.g., doors, windows). For this ECO, it will be assumed that the doors and windows will not be replaced.

b. Insulation. The AE shall determine the appropriate type and quantity of insulation based on the audit findings. Insulation installation/enhancement will be evaluated to tighten the building envelop (e.g., walls, attic, basement, crawl spaces). The cost/benefits will be calculated.

c. Storm Doors. The cost/benefits shall be calculated for the installation/replacement of storm doors. Included in this ECO will be replacement of door frames and any necessary weatherstripping.

d. Storm Windows. The cost/benefits shall be calculated for the replacement of windows and the installation/replacement of storm windows (interior/exterior). Included in this ECO will be replacement of frames and weatherstripping on the frame.

e. Ventilation Systems. The cost/benefits shall be calculated for the installation/replacement of attic ventilating systems.

f. Building Envelop. The AE shall identify additional energy conservation opportunities relative to insulation that are not listed above.

g. Exterior Modifications. All modifications effecting the exterior of the housing unit(s) shall be reviewed and approved through the Environmental and Natural Resources Division of the Fort Belvoir Directorate of Public Works subsequent to the prefinal submittal.

5. ECO Analysis. The ECOs listed above will be analyzed against the existing conditions for each model type and projected out over the model population. Each ECO will be analyzed individually, per area listed in paragraph 2 above, for energy and cost savings using ECIP criteria. The program simulation used for the analyses will be approved by the Installation. The total project will be extrapolated into a complete ECIP document. The final document will be suitable for submission into the program for funding.

6. Market Analysis. A market analysis will be conducted to determine efficient and reliable products to successfully realize the potential of each ECO. At least one product will be recommended for each ECO evaluated (e.g. window, door, weatherstripping). Price information and specifications will be provided. Generalities will be unacceptable.

7. Submittals. The work accomplished shall be fully documented in a comprehensive report. The report shall have a table of contents and have appendices. All pages shall be numbered, even the appendices. The AE shall provide calculations needed to support all data presented. The calculations shall be an orderly step-by-step progression from the first assumption to the final number, showing how all numbers in the analysis were developed. All assumptions shall be clearly stated. Descriptions of the products, catalog cuts, pertinent drawings, and sketches shall also be included. Each submittal shall consist of three (3) copies, four bound and one (1) in a three ring binder.

a. Interim Submittal. The interim report shall present the work that has been accomplished to date, illustrate the methods and justifications of the approaches taken, and contain a plan for completing the remaining work.

b. Prefinal Submittal. The prefinal report shall be a comprehensive document detailing the analyses performed under this contract and the logical conclusions.

c. Final Submittal. Any revisions or corrections resulting from comments made during the review of the prefinal report or during the presentation and review conference shall be incorporated into the final report. Pen and ink changes or errata sheets will not be acceptable.

d. Comments. Government comments to all submittals, except the final submittal, will be delivered to the AE in written form. The Government will require two weeks to review each submittal. Meetings will be scheduled as necessary to discuss those comments that the AE does not concur with or does not understand.

8. Interviews. The AE shall conduct entry and exit interviews with representatives from the Directorate of Engineering and Housing before starting work at the installation and after completion of the prefinal submittal. The interviews shall be scheduled at least one week in advance.

a. Entry. The entry interview shall thoroughly brief and describe procedures for the study and shall be conducted prior to commencing work on the study.

b. Exit. The exit interview shall summarize the work performed and present the conclusions and recommendations.

9. <u>Services and Materials</u>. All services, materials, labor, and travel necessary to perform the work and render the data required under this contract are included in the lump sum of the contract.

10. <u>Deliverables</u>.

a. <u>Interim Submittal</u>. 120 ~~90~~ calendar days from date of receipt by the AE firm of the delivery order.

b. <u>Prefinal Submittal</u>. 90 ~~60~~ calendar days from date of receipt by the AE firm of review comments on interim submittal.

c. <u>Final Submittal</u>. 30 ~~21~~ calendar days from receipt by the AE firm of review comments on the prefinal submittal.

d. <u>Government Review Time</u>. Government review and comments on the interim submittal will normally take one to ~~two~~ four weeks.

12. Computer Modeling

~~If it is possible tha~~t The buildings in this study will be subject to the computer modeling requirements of paragraph 2.6, ~~then the simulation programs acceptable to the office doing the technical review should be listed in the detailed scope of work.~~ Some acceptable simulation programs follow:

JH 17 Sep 9?

a. Building Loads and System Thermodynamics (BLAST) *

b. DOE 2.1B *

c. Carrier E20 or Hourly Analysis Program (HAP) **

d. Trane Air-Conditioning Economics (TRACE) ** — A-E shall use this system

e. "A computer program titled Life Cycle Costing in Design (LCCID) is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program can be used for performing the economic calculations for ECIP and non-ECIP ECOs. The AE is encouraged to obtain and use this computer program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. The telephone number is (217) 333-3977 or (800) 842-5278."

4

13. Government Furnished Information:

* (1) ETLs 1110-3-254, Use of Electric Power for Comfort Space Heating (if applicable), and 1110-3-282, Energy Conservation

* (2) Architectural and Engineering Instructions.

* (3) Energy Conservation Investment Program (ECIP) Guidance, dated 4 Nov 1992 and the latest revision with current energy prices and discount factors for life cycle cost analysis.

* (4) TM 5-785, Engineering Weather Data, TM 5-800-2, General Criteria Preparation of Cost Estimates.

* (5) AR 5-4, Change No. 1, Department of the Army Productivity Improvement Program.

* (6) AR 415-15, 1 Jan84, Military Construction, Army (MCA) Program Development

* (7) The latest MCP Index.

14. Facility Assistance Representative

Mr Mike Strimbaugh
Energy Coordinator
703 806-4007

ANNEX B

EXECUTIVE SUMMARY GUIDELINE

1. Introduction.

2. Building Data (types, number of similar buildings, sizes, etc.)

3. Present Energy Consumption of Buildings or Systems Studied.

   o Total Annual Energy Used.

   o Source Energy Consumption.

Electricity	- KWH, Dollars, BTU
Fuel Oil	- GALS, Dollars, BTU
Natural Gas	- THERMS, Dollars, BTU
Propane	- GALS, Dollars, BTU
Other	- QTY, Dollars, BTU

4. Reevaluated Projects Results.

5. Energy Conservation Analysis.

   o ECOs Investigated.

   o ECOs Recommended.

   o ECOs Rejected. (Provide economics or reasons)

   o ECIP Projects Developed. (Provide list)*

   o Non-ECIP Projects Developed. (Provide list)*

   o Operational or Policy Change Recommendations.

* Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date.

6. Energy and Cost Savings.

   o Total Potential Energy and Cost Savings.

   o Percentage of Energy Conserved.

   o Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

DEPARTMENT OF THE ARMY
ASSISTANT CHIEF OF STAFF FOR INSTALLATION MANAGEMENT
600 ARMY PENTAGON
WASHINGTON DC 20310-0600

10 JAN 1994

CF: ea section 5/3/94

DAIM-FDF-U

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Energy Conservation Investment Program (ECIP) Guidance

Design BI

1. The purpose of this memorandum is to provide updated guidance for the Energy Conservation Investment Program (ECIP). This guidance is effective upon receipt and will be applied to FY95 submissions and management of all current projects.

2. The ECIP is a special Military Construction (MILCON) funded program to improve the energy efficiency of existing facilities. Projects funded under ECIP can improve living and working conditions of Army personnel, enhance mission capabilities, and decrease negative environmental impacts of energy systems. Funds designated for ECIP are managed by DOD and do not compete with Army's MCA program. The ECIP MILCON program has separate project submission and execution requirements.

See Par 3(f) 3.1%

3. The National Energy Policy Act (PL 102-486) and recent DOD guidance have placed renewed emphasis on energy conservation. Installations/MACOMs should use ECIP, along with other programs, to assist in meeting the Army's energy reduction goals.

4. Enclosure provides the new ECIP guidance. The following significant points are highlighted:

a. The Army share of ECIP funding ($12.8 million per year FY94 through FY97) is expected to substantially increase. Well documented and justified projects are important in competing for these resources.

b. Projects are ranked by savings to investment ratio, therefore, an accurate and complete economic analysis is important.

c. The economic analysis guidance has been updated to include the most recent discount and energy escalation factors.

d. The guidance can be used for developing energy conservation, water conservation, and alternate and renewable energy resource projects.

e. Because of increasing emphasis on program status, new guidance on reporting is provided to keep DOD informed of project execution and results.

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(ATTN: CECER-ES), P.O. BOX 9005, CHAMPAIGN, IL 61826-9005
US ARMY ENGINEER ACTIVITY, CAPITAL AREA, (ATTN: CENAC-CD)
FORT MYER, VA 22211-5050
US ARMY ENGINEER COLD REGIONS RESEARCH AND ENGINEERING
LABORATORY, (ATTN: CECRL) 72 LYME ROAD, HANOVER, NH 03755-1290
US ARMY ENGINEER WATERWAYS EXPERIMENT STATION, (ATTN: CEWES)
3909 HALLS FERRY, VICKSBURG, MS 39180-6199
US ARMY ENGINEER DIVISION, NORTH CENTRAL, (ATTN: CENCD)
536 S. CLARK STREET, CHICAGO, IL 60605-1592
US ARMY ENGINEER DIVISION, LOWER MISSISSIPPI VALLEY,
(ATTN: CELMV) P.O. BOX 80, VICKSBURG, MS 39180

5. In summary, funding for the ECIP program is increasing and new opportunities exist for MILCON energy and water conservation projects. The enclosed documentation should help prepare effective projects.

6. We strongly encourage your continued support and participation in this important program. For further information, please contact Henry Gignilliat, DAIM-FDF-U, at (703) 355-2003 or DSN 345-2003.

FOR THE DIRECTOR OF FACILITIES AND HOUSING:

John J. Krajewski

Encl

JOHN J. KRAJEWSKI
Chief, Facilities Policy Division

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DAIM-FDF-U
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CESAM-EN-CC (MR. BATTAGLIA)
LOEA-PL (MR. KEATH)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) GUIDANCE

1. DEFINITION: ECIP is a subset of the Military Construction (MILCON) program specifically designated for energy saving projects for facilities. It is used to fund any MILCON scope projects that are initiated to reduce energy use through construction of new, high efficiency energy systems or the improvement and modernization of existing Army owned energy systems, buildings, or facilities for which the Department of the Army pays for the energy.

2. SCOPE: The currently projected funding levels of ECIP not including design is $50 million per year as shown below:

	$Millions FY94	FY95	FY96	FY97	FY98	FY99
Army	12.8	12.8	12.8	12.8		
Navy	19.3	19.3	19.3	19.3	to be	
USMC	2.5	2.5	2.5	2.5	determined	
Air Force	14.9	14.9	14.9	14.9		
Def Agencies	.5	.5	.5	.5		
	50.0	50.0	50.0	50.0		

NOTE: Additional opportunity for MILCON funds are expected each program year. A sufficient supply of competitive ECIP projects can result in an increase in Army ECIP funding for any given fiscal year.

3. GENERAL:

a. ECIP projects will be prioritized on the basis of the greatest life cycle payback as determined by the savings-investment-ratio (SIR). The SIR will be calculated by the economic analysis method contained in this guidance.

b. The SIR calculation will be performed using the mode of analysis of the National Institute of Standards and Technology (NIST) Handbook 135, "Life Cycle Cost Manual for the Federal Energy Management Program." A recommended simplified economic analysis summary format is provided in Appendix A.

c. A life cycle cost analysis for each overall project and for each discrete retrofit action (i.e., storm windows, insulation, economizer, etc.) will be performed and be included with the DD Form 1391 project documents submitted for consideration.

d. Overall projects and discrete portion of projects must have a SIR equal to or greater than 1.25.

e. All SIR calculations and analyses will be based upon the recommended economic life, (See Appendix B), the useful life of the retrofit action, or the remaining life of the facility affected, whichever is least.

f. Present worth discounting will be done using the current year discount factor (3.1%). Uniform present worth (UPW) and single present worth (SPW) factors for use in determining present worth of non-energy costs/savings are given in Tables A and B respectively. Uniform present worth (UPW) factors for annual energy costs/savings for the various regions are given in Tables 1 through 5. Overseas installations will use the U.S. average (Table 5). These present worth factors will be used until superseded by new guidance.

g. The estimated construction cost, the labor and material costs, and the actual current unit costs of the energy at the facility, rather than stock fund prices, will be used as the basis for energy cost analysis. (Stock fund prices might be out of date and include storage and other overhead costs.)

h. Care will be taken in computing energy savings to ensure that energy savings are not duplicated between projects or portions of projects.

i. Temporary Buildings

For each temporary building included in a project, separate documentation is required showing, a minimum 10 year continuing need for active building retention after retrofit, the specific retrofit action applicable and an economic analysis supporting the specific retrofit.

Temporary buildings in ECIP projects will be documented as included in an installations annual real property utilization survey (AR 405-70). Projects for temporary buildings on semiactive installations should address areas where savings will result during seasonal use, e.g., hot water.

j. Non-Appropriated Funded Facilities

Non-appropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are paid for by the Army.

4. PROJECT DOCUMENTATION:

a. DD Forms 1391 will contain the notation "ECIP" in the title block and will include a line item identification, description, location, CWE, total project SIR, annual dollar savings and annual energy savings.

b. Project submittal will include copies of the life cycle analyses for the discrete portions and of the overall project.

supporting documentation consisting of basic engineering and economic calculations showing how savings were determined will be included in the submittal. Sample format of the analyses and summary sheet are provided in Appendix A. Computer generated summaries are acceptable provided they conform to the above guidance.

c. Project descriptions must clearly define the conservation measures from which the energy savings will result and the specific facilities being built or modified by the project.

d. Project documentation shall be in metric units in support of goals established under Executive Order 12770 "Metric Usage in Federal Government Programs" dated July 25, 1991.

e. Project documentation will include a statement regarding whether or not the installation affected by the project is being considered for closure or realignment. If so, an explanation must be provided for why the project is being considered in face of the closure or realignment.

5. ENERGY CONVERSIONS:

a. For purposes of calculating energy savings, the following conversion factors are to be used:

Purchased Electric Power	3,413 BTU/KWh	3.6 MJ/kwh
Purchased Steam	1,340 BTU/lb	1.41 MJ/lb
Distillate Fuel Oil	138,700 BTU/gal	38.6 MJ/L
Natural Gas	1,031 BTU/cu ft	38.85 MJ/cu m
LPG, Propane, Butane	95,000 BTU/gal	24.6 MJ/L
Bituminous Coal	24,580,000 BTU/ Short Ton	28,592 MJ/ metric ton
Anthracite Coal	25,400,000 BTU/ Short Ton	29,546 MJ/ metric ton
Residual Fuel Oil	Average thermal content of oil at each installation	

b. Purchased energy is defined as being generated offsite. For special cases where electric power or steam is obtained from on-site sources, the actual average gross energy input to the generating plant will be used.

c. The term "coal" does not include lignite. Where lignite is involved, the Bureau of Mines average value for the source field shall be used.

d. Where refuse derived fuel (RDF) is involved, the heat value shall be the average of the RDF being used or proposed.

e. When the average fuel oil heating value is accurately known through laboratory testing for a specific military installation, that value may be used in lieu of the amount

specified in paragraph 5.a.

f. Full energy credit may be taken for conversion from fossil fuels or electric power to solar, wind, RDF, or geothermal energy less the calculated average yearly standby requirement.

6. ECONOMIC ANALYSIS: The savings-to-investment ratios and payback periods shall be arrived at using the following guidance:

a. Life Cycle Cost (LCC) analyses are to be performed on all projects, and discrete elements of projects, using the method required by 10 CFR, Part 436, Subpart A.

b. The National Institute of Standards and Technology (NIST) has developed the following three tools (available from NIST by calling (703) 243-4900) to assist in the economic analysis of candidate ECIP projects:

(1) Life-Cycle Costing Manual for the Federal Energy Management Program. NIST Handbook 135 (current version 1987)

(2) Present Worth Factors for Life-Cycle Cost Studies in the Department of Defense (1994), NISTIR-4942-1 (updated annually), included in this document is a Memorandum of Agreement on Criteria/Standards for Economic Analysis/Life Cycle Costing for MILCON Design dated 18 March 1991, which includes further clarification of the basic life cycle analysis assumptions and criteria .

(3) NIST "Building Life Cycle Cost" (BLCC) Computer Program, Note: Use the most recent version available - Latest version 3.2, October 1, 1992.

The Life Cycle Cost in Design (LCCID) computer program can also be used to perform economic analyses. The LCCID program and application assistance is available from the Building Loads Analysis System Thermodynamics (BLAST) Support Office, Army Construction Engineering Research Laboratory, IL, by calling 1-800-842-5278.

c. Actual cost of the energy purchased for use at the facility (i.e., cost to the Government, not Defense Fuel Supply Center (DFSC) or Defense Base Operating Fund stock fund prices) will be used as the basis for energy cost analysis. The format to be used for ECIP Economic Analysis included in paragraph 11E of the DD 1391 submittal is given in Appendix A.

7. PROGRAMMING CRITERIA:

a. ECIP projects will be prioritized and ranked for funding on the basis of the greatest potential life-cycle payback for dollar invested as indicate by SIR.

b. Projects which substitute renewable energy for

nonrenewable energy or include water conservation can be subjectively considered for increased priority based on the magnitude of their additional benefits.

c. Since there is uncertainty over future force level and base structure, a sensitivity analysis must be conducted to determine if there is likelihood that expected changes might alter the economic benefits. Increased risk identified as a result of this sensitivity analysis may be used to lower a project's programming priority.

d. The minimum economic return for inclusion of an ECIP project is a SIR greater than 1.25 and a simple payback period that is less than 10 years.

e. Energy Monitoring and Control System projects must have the Installation Commander's certification that appropriate resources will be committed to effectively operate the system over the life cycle of the investment.

f. Projects will be classified into one of the ten categories listed in Appendix B. A project will be classified under a category if at least 75 percent of the scope of work falls under that category. Projects which do not contain at least 75 percent of any category shall be classified as "Facility Energy Improvement" projects.

8. ANNUAL REPORT:

a. Each participating MACOM, with assistance of the installation and District Engineers, will submit to DAIM-FD-U by 1 February each year, an ECIP annual summary report.

b. The report will include, for each FY program not previously reported as complete, a listing (based on the latest scope) of the MACOM's projects along with the actual expenditure for completed projects or current working estimate, annual energy savings (MBTU), and first year cost savings ($000). Current engineering estimates may be used if actual validated energy savings data is not available.

c. A separate information sheet shall be submitted for any project canceled, deferred beyond the program year authorized or whose current cost or scope is changed by more than 25% from the original estimate, or whose current dollar or energy savings (estimated or actual) is less than 75% of the amount originally reported. This information sheet will explain the technical and/or the economic basis for the change.

9. PROGRAM REVIEW:

a. A program review will be conducted by DOD mid year to determine the status of the program execution and to verify the projected savings. In addition, the Defense Inspector General

will make periodic audits of ECIP as part of the overall audit of the Energy Resource Management Program.

b. To maintain creditability of the ECIP and provide and explain current project data which is not in agreement with data as approved by DOD, it is essential that documentation be diligently maintained by installations, MACOMs and District Engineers. The data should include scope and scope changes, design projection, and auditable trails of cost, cost avoidance, energy savings, savings to investment ratios, simple payback, etc. Each level of command should assist in maintaining the audit trails in order to provide quick positive response to DoD.

10. <u>MANAGEMENT RESPONSIBILITIES</u>: MACOMs and installations, Corps of Engineer Divisions and Districts, within their area of responsibility, will:

a. Identify and accomplish all energy conservation measures with a 10 year or less payback;

b. Submit project documentation, through the normal Military Construction review and verification process, to the Assistant Secretary of the Army for Installation Management (DAIM-FDF-U) by 1 February each year for the following Fiscal Year;

c. Ensure that all cost-effective low-cost/no-cost conservation and rehabilitation actions which would reduce an individual ECIP project scope, and are executable within available installation resources, are taken prior to project development;

d. Ensure that all projects are designed and constructed within the original scope as forwarded to Congress and within funds allocated by the OSD comptroller;

e. Ensure that all monies authorized and appropriated for ECIP are used for energy conservation purposes;

f. Reevaluate savings estimates and program compliance whenever scope, savings or cost estimates change by more than 25 percent;

g. Revalidate all projects prior to requesting advertising authority to ensure that contemplated benefits will still accrue.

Projects may be considered valid if the Savings-to-Investment ratio remains above 1.25. This will ensure that projects funded within the 25% variation allowance still achieve a positive return on investment over the life of the project. However, for programming purposes, ECIP projects with comparatively low savings-to-investment ratios are less likely to be funded than those with high ratios.

In the event that a project cost estimate changes by more than 25 percent of that furnished to Congress (the original estimate attached to the DD 1391 submitted to DOD) or the scope is reduced by 25 percent to allow award within the original estimate, notify the Assistant Secretary of the Army for Installation Management (DAIM-FDR) of the circumstances causing the contract change. Contracts and contract modifications may be awarded 21 days after DAIM-FDR notifies OSD provided no objections exist. Contracts and contract modifications may be awarded prior to the 21 day period with OSD concurrence;

h. Maintain current, auditable documentation on execution status and the projected and realized savings for each approved ECIP project. Auditable documentation includes section 11C and 11D of the DD 1391 (see sample at enclosure 1), including basic engineering and economic calculations;

i. Provide an annual report on the status of the ECIP to Office of Assistant Chief of Staff for Installation Management (DAIM-FDF-U) by February 1 of each year (Section 8) for incorporation by DOD in Department of Energy's report to Congress.

The report shall also include a project status list of all ECIP projects for each of the past five years indicating: original approved costs; current working estimates; the original and current estimated savings, savings-to-investment ratio, and payback periods; and whether or not the contract has been awarded, completed, cancelled, or deferred. Computer generated reports in spread sheet format are acceptable in accordance with the sample format provided in Appendix C.

Projects added will be identified without an original estimate and projects cancelled or deferred without a current working estimate. Projects added, deferred, cancelled or changed by more than 25 percent, will be identified in the status column.

DISCOUNT FACTORS FOR NON-ENERGY COSTS/SAVINGS

The following UPW factors (Table A) for annual recurring and SPW factors (Table B) for non-recurring costs/savings are based on a 3.1% discount rate.

TABLE A

STUDY PERIOD YEARS	UPW FACTOR
1	0.97
2	1.91
3	2.82
4	3.71
5	4.57
6	5.40
7	6.21
8	6.99
9	7.75
10	8.49
11	9.20
12	9.89
13	10.57
14	11.22
15	11.85
16	12.47
17	13.06
18	13.64
19	14.20
20	14.74
21	15.27
22	15.78
23	16.27
24	16.75
25	17.22

TABLE B

STUDY PERIOD YEARS	SPW FACTOR
1	0.97
2	0.94
3	0.91
4	0.89
5	0.86
6	0.83
7	0.81
8	0.78
9	0.76
10	0.74
11	0.71
12	0.69
13	0.67
14	0.65
15	0.63
16	0.61
17	0.60
18	0.58
19	0.56
20	0.54
21	0.53
22	0.51
23	0.50
24	0.48
25	0.47

TABLES 1 THROUGH 5

Discount Factors Adjusted for Energy Price Escalation

The following "modified" uniform present worth (UPW) discount factors are based on a 3.1% discount rate and include the projected escalation rates in energy prices from 1993 to 2028 for the 4 Census Regions and the United States average. The factors are modified in the sense that they incorporate projected energy prices changes. The UPW factors incorporate rates of change in energy prices computed from indices projected by the Energy Information Administration (EIA) of the U.S. Department of Energy. The EIA data are stated as annual averages. Therefore, the factors are not tied to a particular calendar date in the year.

TABLE 1-CENSUS REGION 1:Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania

TABLE 2-CENSUS REGION 2:Ohio, Indiana, Illinois, Michigan,Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas

TABLE 3-CENSUS REGION 3:Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, Texas

TABLE 4-CENSUS REGION 4:Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, Hawaii

TABLE 5-CENSUS REGION 5:United States Average to be used for all OCONUS

General

The form on page A1 is to be used for determining Savings to Investment Ratios (SIR) for complete ECIP projects and for discrete portions of projects. In using this form, the cost of construction; supervision; inspection and overhead (SIOH); design costs, salvage value; unit costs of energy; and recurring and nonrecurring non-energy costs are determined as of the date the analysis is made.

Title Block

Identify project title (see Appendix B), and if applicable, the discrete portion of the project being analyzed. The installation region is determined by its location (see Tables 1 through 5). (OCONUS use Table 5). The economic life is the period of time over which the savings from a project may reasonably be expected to accrue (see Appendix B).

Line 1 Investment Cost

All investment costs are determined as of the date the analysis is made. Salvage value is the residual value of existing equipment removed as a result of the retrofit project. Investment costs do not include energy audit costs, preliminary design, nor analysis costs since these efforts are required by Executive Order, legislation, or DoD requirements and are therefore considered sunk costs.

Line 2 Energy Savings

By definition ECIP projects must save money, therefore there will always be an overall energy cost savings. The overall savings may include increases in use of one fuel and an decrease in use another. Use conversion factors in paragraph 3 of the guidance to convert to MBTUs and metric units. (On the economic summary sheet indicate energy savings and unit energy costs with metric in parentheses.) If the energy source fuel type is not listed, include it under line 2G. The cost per MBTU (MJoules) (1) is the cost of energy at the installation on the date of the analysis. For each fuel, attach information to show and substantiate the energy savings (2) claimed. The annual savings is the product of (1) x (2). The discount (UPW) factors (4) are obtained from the appropriate table 1 through 5. For energy sources not listed in tables 1 through 5 and demand savings, use the UPW factors from Table A. The discounted savings (5) are determined by multiplying (3) x (4).

Line 3 Non-Energy Savings

Annual recurring savings/costs will include items such as electrical demand savings, operator/maintenance savings (labor and materials). Non-recurring savings/costs will include periodic maintenance and integral parts replacement costs. All

costs are to be estimated as if they will be incurred on the analysis date. Include backup data substantiating all costs/savings. For annual savings/costs obtain the discount (UPW) factor from Table A. For each non-recurring item enter the analysis years in which it occurs, obtain the discount (SPW) factor from Table B and calculate the discounted savings/costs by multiplying (1) x (3).

Line 4

The first year dollar savings is defined as the summation of the first year energy and non-energy savings plus the total nonrecurring non-energy savings divided by the economic life of the retrofit action (2I3 + 3A + (3Bd1/years economic life)).

Line 5

The simple payback is equal to the total investment divided by the first year dollar savings (1G/4).

Line 6

Total net discounted savings equals the energy discounted savings plus the total non-energy discounted savings (2I5 + 3C).

Line 7

Savings-to-investment ratio equals the net discounted savings divided by the total investment (6/1G). The project qualifies for inclusion in the program if SIR on Line 7 is equal to or greater than 1.25.

ENERGY CONSERVATION PROJECT TYPES
(Recommended Economic Analysis Life)

Category	Title	Description
1.	EMCS or HVAC Controls (10 years)	Projects which centrally control energy systems with the ability to automatically adjust temperature, shed electrical loads, control motor speeds or adjust lighting intensities.
2.	Steam and Condensate Systems (15 years)	Projects to install condensate lines, cross connect lines, distribution system loops, repair or install insulation and steam flow meters and controls.
3.	Boiler Plant Modifications (20 years)	Projects to upgrade or replace central boilers or ancillary equipment to improve overall efficiency. This includes fuel switching of dual fuel conversions.
4.	Heating, Ventilating, Air-Conditioning (HVAC) (20 years)	Projects to install more energy efficient heating, cooling, ventilation or hot water heating equipment. This includes the HVAC distribution systems (ducts, pipes, etc).
5.	Weatherization (20 years)	Projects improving the thermal envelope of a building. This includes building insulation (wall, roof, foundation), insulated doors, windows, vestibules, earth berming, shading, etc).
6.	Lighting Systems (15 years)	Projects to install replacement lighting systems and controls. This would include daylighting, new fixtures, lamps, ballasts, photocells, motion sensors, IR sensors, light wells, highly reflective painting, etc.
7.	Energy Recovery Systems (20 years)	Projects to install heat exchangers, regenerators, heat reclaim units or recapture energy lost to the environment.
8.	Electrical Energy Systems (20 years)	Projects that will increase the energy efficiency of an electrical device or system or reduce cost by reducing peak demand.
9.	Renewable Energy Systems (20 years)	Any project utilizing renewable energy. This includes active solar heating, cooling, hot water, industrial process heat, photovoltaic, wind, biomass, geothermal, and passive solar applications.
10.	Facility Energy Improvements (20 years)	Multiple category projects or those that do not fall into any other category.

Appendix B

Appendix K

Comments and Responses

(NO. 3)

Minutes of Meeting

Project: Ft. Belvoir Family Housing Insulation Study   Date: 11/22/94

Subject	Decision/Action Summary
General Discussion	The Interim Submittal (record copy) did not have corrections annotated, but was accepted as-is. The Pre Final re-submittal should include notes indicating changes as a result of review comments. Mr. Hawk provided a copy of an Executive Summary from a previous report for reference. The format in this report was acceptable to COE and can be followed for this study. All data from the Life Cycle Cost Analysis Summary sheets should be tabulated in the Executive Summary. All ECOs should be listed with results then packaged together into projects, with appropriate programming documents. Mike Stumbaugh indicated that the Life Cycle Cost Analysis Summary sheet are the only programming documents necessary.
Review of Comments	Agreed Upon Course of Action: Hawk's Comments: 1. EYP will include a copy of the review comments in the appendix of the revised report. Where corrections are mad in response to these comments a notation will be used to reference the appropriate comment. 2- 5. These comments where covered in the above referenced General Discussion. 6. EYP will list all ECOs in a tabular form in the Executive Summary. 7. This covers the same subject as comment 6. 8. The ECOs were not packaged in accordance with the Sco of Work. EYP will package the ECOs into projects as determined by Mike Stumbaugh and will provide the necessary programming documents (Life Cycle Cost Analysis Summary sheets) in the Executive Summary.

Minutes of Meeting

Subject	Decision/Action Summary
	Stumbaugh's Comments: 1. EYP will include page number references in the Table of Contents. 2. This comment was covered in the General Discussion referenced above. 3. EYP will state in the Executive Summary that the 5% sample of units is assumed to be representative of the entire study area. 4. The savings was not double counted but the wording was redundant. EYP will change the sentence 'Each ECO will be analyzed....' to read 'See Section IV BUILDING ANALYSIS, paragraph B.2 for detailed description of procedure for ECO selection. 5. EYP will state all assumptions. 6. EYP will change all references to 'DEH (Directorate of Engineering and Housing)' to read 'DPW (Directorate of Public Works). 7. No actions have been recommended in paragraph 4. In paragraph 5 insulation of water heaters in unheated crawl spaces, the activation of whole house (ceiling) fans and selective replacement of incandescent light fixtures with fluorescent type. The term 'old forests' is correct and will remain. 8. EYP will correlate the listing of ECOs in paragraph 3 to those found on page 6 including those rejected. 9. EYP will delete the redundant reference to description of work.

Subject	Decision/Action Summary
	10. EYP will explain the lighting to be changed and provide the justification for the decision. 11. EYP assumed that the occupants could perform the duty of 'night setback' without the need for a programmable thermostat. This assumption was challenged by the Mr. Hawk and Mr. Stumbaugh. EYP will give further consideration to the use of programmable thermostats. 12. EYP will define the * on every page that it appears. 13. EYP will include the * on paragraph C. Purnell's Comments (*Updated 12/15/94 to include response from EYP): 1. EYP will number all pages including the appendices. 2. EYP will describe the efficiency of the air cooled condensing units where known. (*These are Trane XE-1000 series units, with SEER in the range of 9.5-10.5) 3. EYP will explain the schedules of occupancy used in the study. (*It is correct that the assumption was made that the typical housing unit was essentially unoccupied during the daytime hours as shown in the ASEAM input files. This was the observation made during our site survey visits. The only ECO analyses which would be affected by the redefinition of 'occupied' vs. 'unoccupied' hours should they be revised are those of the "Programmable thermostats". Calculations of these ECO's will remain unchanged unless EYP is specifically directed to do so). 4. EYP will explain all assumptions about the U-values of windows. (*ASHRAE recommends that an adjustment factor of 0.85-0.95 be applied to the U-factors of wood frame windows. For this study, a factor of 0.90 was used,

Minutes of Meeting

Subject	Decision/Action Summary
	which is why the U-factor of windows is 0.49 instead of 0.55)
Re-submittal	EYP will revise and resubmit the Pre Final report on January 18, 1995. EYP will deliver one copy of the report to each of the following agencies: 1. Mr. James Hawk CENAB, AE Acquisition Branch City Crescent Building 10 S. Howard Street Baltimore, Maryland 21201 2. USA Garrison - Ft. Belvoir Attention Mike Stumbaugh 9430 Jackson Loop, Suite 107 Ft. Belvoir, Virginia 22060 3. U.S. Army Corps of Engineers Mobile, Alabama (Mr. Hawk is to provide the complete address for this agency) All copies of the report will be in three-ring binders.
Payment	Mr. James Hawk will process payment of an EYP invoice for 65% of the total contract amount for work completed to date.

Insulation Study — 5 pages

1. Study has not determined that EYP's letter of 15 June 94 has been complied with. Report has not been marked or noted to indicate compliance

2. Same comment as #1 only addressed to EYP letter dated 15 July 1994.

3. EYP did not conform to Scope of Work for Prefinal submittal.

4. EYP did not provide executive summary in format of Scope of Work

5. Study did not make any comments about Record Report for Interim Report in Pre Final

6. ECO's are not listed in order as determined by Scope of Work, need charts or lists

7. ECO's are not listed with provisions of paragraph 7 page 3 of Scope Of Work, Charts require

8. ECO's have not been packaged as per par 2.7 of General Contract · need charts or lists

9. ECIP projects have not been identified as per paragraph 5.1

2

10 Non Ecip projects have not been identified as per paragraph 5.2 - need charts & lists tables

11. No cost / low cost items have not been identified as per paragraph 5.3. charts / lists

12 No record of evaluated selected ECO's can be found in report - in chart, tables & li

13 Recommended Projects of ECO's can not be found as per par 7.5.

14 Comprehensive reports of ECO's can not be found in report as per 7.6

15. ECO's shall be grouped as noted in par 7.6.1 of general scope of work

16 Executive Summary - not as per par 7.6.2 of scope of Work

17, All ECO packages shall include or be considered with synergistic effects

18 Post DOCUMENTS Required For ECO packages not included paragraph 5.1

19. ECIP ~~sheets~~ appear to be for 1 unit however in all cases ~~the~~ ECIP sheets should reflect total number of units in each area

V.C.

File: B:\FHINSULT.CMT
Printed: Thursday October 20, 1994 at 11:52:54 a.m.

Project Info: EEAP study for the insulation of Family Housing Units

Num	Name	Office	Page/Sheet	Discipline	Rm/Detai
1	STUMBAUGH	PWE	TABLE-CONT	MEC	

The table of contents should reference the page numbers on which the sub areas are found.

2	STUMBAUGH	PWE	PAGE-1	MEC	EX SUM

The executive summary must be concise. The first paragraph is fine. The paragraph should be a list of the projects developed, including those ultimately rejected. Next should be the tabular results similar to those presently on page 7, again including the rejected projects. ECIP project should follow - including statements of work and any drawings necessary t complete the description. The executive summary should be designed for th Director of Public Works to look at quickly, understand the gross numbers a decision, and be able to access the project documentation. Existing conditions and details on methodology must be relocated to the next porti the report.

3	STUMBAUGH	PWE	PAGE-8	MEC	II.B.2.

State in paragraph B.2. that the 5 percent sample will be assumed representative of the whole.

4	STUMBAUGH	PWE	PAGE-9	MEC	II.B.4.

ECO Analysis - Were the savings 'double-counted' using this method? How this section relate to page 21, paragraph 2.c. ?

5	STUMBAUGH	PWE	PAGE-11	MEC	III.B.2.

Please make paragraph 2, 'Variances', clearer. Define significant variar

6	STUMBAUGH	PWE	PAGE-15	MEC	C.(2)

DEH (Directorate of Engineering and Housing) is now the DPW (Directorate Public Works). Please change this reference throughout the report.

7	STUMBAUGH	PWE	PAGE-16	MEC	C.(4)+

Is action recommended as a result of the findings in paragraphs 4, 5, anc The term 'old forests' seems inaccurate in paragraph 6.

8	STUMBAUGH	PWE	PAGE-21	MEC	B.3.

Please correlate the listing of ECOs in paragraph 3 to those found on pa including those rejected.

9	STUMBAUGH	PWE	PAGE-21,22	MEC	IV.C.

The descriptions of work (DoWs) should be consistent throughout the docu

File: B:\FHINSULT.CMT
Printed: Thursday October 20, 1994 at 11:52:55 a.m.

Project Info: EEAP study for the insulation of Family Housing Units

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail

They should be sufficient for a competent contractor to execute the project with a minimum of additional documentation. Drawings should be included as necessary.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
10	STUMBAUGH	PWE	PAGE-22	MEC	IV.C.

'Lighting Fixture Replacement' - The actual lighting to be changed must be defined. Does this lighting include the exterior lighting?

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
11	STUMBAUGH	PWE	PAGE-23	MEC	4.(4)

Explain with greater clarity why the thermostats are not justifiable.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
12	STUMBAUGH	PWE	PAGE-26	MEC	TABLE

Define the * on every page it is found.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
13	STUMBAUGH	PWE	PAGE-28	MEC	*

The * should be included in paragraph C.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
14	STUMBAUGH	PWE	PAGE-28+	MEC	DOWS

The Descriptions of Work (DoWs) must be sufficient for a competent contractor to execute the work with little additional documentation. Drawings should be included as necessary. The DoWs should be consistent throughout the document.

October 17, 1994
Sort Type = None

FAMILY HOUSING INSULATION (ECO) STUDY @ FT. BELVOIR, VA.

File: K:\TECHDATA\ARMS\MECH\DB4340DP.DBF

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
1	PURNELL	CENABEN-DM	STUDY-GEN	MEC	INT. SUB.

Number all pages for reference. √

2	PURNELL	CENABEN-DM	INTERIM-SUB	MEC	PAGE-1

Paragraph B.2: Describe the efficiency status of the air-cooled condensing units. (These are TRANE equipment; typical SEER ≅ 9.0 to 10.0)

3	PURNELL	CENABEN-DM	INTERIM-SUB	MEC	APPEND. C

Loads Input Files/Typical Occupied Schedule: Explain these schedules. One would assume that there would be 24 hour occupancy in these homes but with some diversity factor assumed. Are you saying that there is no occupancy on weekdays from 0800-1800 hours, no occupancy on Saturdays from 1000-2000 hours, and no occupancy on Sundays from 0800-1600 hours? After clarifying the schedule question, please verify if new calculations are required.

4	PURNELL	CENABEN-DM	INTERIM-SUB	MEC	APPEND. C

Your U-Factors for windows, .49 Btuh/ft2-deg F does not match the .55 Btuh/ft2-deg F value shown in ASHRAE Fundamentals page 25.4, Table 5. Please explain or correct. If corrected, then verify if new calculations are required.

~~Adjusted to account for difference (ratio) of net glazing area and gross window area.~~

ASHRAE recommends an adjustment factor of [illegible] [illegible] for U-factor of wood frame windows. For this project, a factor of 0.90 was used. (0.55 × 0.90 = .49

K-8a.6

* RESPONSE TO COMMENTS (NO.2)

June 15, 1994

Mr. James Hawk
CENAB/AE Acquisition Branch
10 South Howard Street
Baltimore, MD 21201

Re: Record Interim Submittal
Family Housing Insulation (ECO) Study
COE Project No. DACA31-92-D-0061
Delivery No. 0005
EYP Project No. 60592.00

Dear Mr. Hawk:

EYP hereby submits the Record Interim Submittal of the referenced project as requested. This submittal incorporates all the corrections required by comments to date from your office and from Mr. Mike Stumbaugh of DPW/Ft. Belvoir, including revisions of both narratives and calculations.

EYP also responds to the second set of comments from Mr. D. Ruhl (dated April 28, 1994) as follows:

No.1 We have eliminated consideration of recommending "circline fixtures" as replacement units for existing incandescent light fixtures as suggested. We are recommending the use of residential type surface-mounted, 4-foot long fluorescent fixtures using 40-w or 34-w (energy efficient) lamps, priced at $115.00 per fixture (installed) for the housing units.

No.2 Per Mr. Cicincione's letter of May 20, 1994, we understand that EYP will not be required to use LCCID, but will continue to use BLCC as the energy analysis routine for this study.

No.3 Under the latest ECIP Guidance, the recommended energy analysis life for "weatherization", "HVAC Equipment" and "Electrical Energy System" is 20 years.

No.4 Please refer to response to No. 1.

No.5 EYP will comply.

EYP is working to complete this study and submit the Pre-Final Submittal on July 15, 1994 per our agreement.

Please feel free to call me at (202) 471-5183 if there is any question in regard to this submittal.

EINHORN YAFFEE PRESCOTT
ARCHITECTURE & ENGINEERING, PC

Julius Stone, P.E.
Project Manager

Enclosure (3 copies of Record Interim Submittal)

cc:

Mr. Mike Stumbaugh, DPW/Ft. Belvoir
File

Thursday April 28, 1994
Last Sort Type = None

Housing Insulation Study, Ft. Belvoir, Addendum

File: C:\ARMS\PUBLIC\HOUSING.DBF

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
1	D.RUHL	CENAB-EN-D		MEC	

Refer to original comment #4 dated 14 Mar 94 --- The circline fixtures are a 1950's dated fixture not attractive enough to be used any longer. The circline replacement lamps are more expensive than 40 W tubes. Please use 2 tube fluorescent fixtures with wrap around lenses. Unless there exists some overwhelming reason to use the circline lamps that we have not been informed about, please eliminate consideration of them. Please incorporate decorative fixtures in the dining rooms, bedrooms, and the living rooms.

2 D.RUHL CENAB-EN-D MEC

Refer to original comment #7 dated 14 Mar 94 --- The LCCID life cycle cost analysis routine is the only known routine that correctly mimics the required economics in accordance with TM 5-802-1. We must be convinced that any other routine which is proposed analyzes the numbers and the economics correctly.

3 D.RUHL CENAB-EN-D MEC

efer to original comment # 13 --- Confirm that the 20 year period for the analysis is correct in accordance with the ECIP criteria for the type of improvement involved.

4 D.RUHL CENAB-EN-D MEC

Refer to original comment # 14 --- The survey discusses circular fluorescent fixtures. The comparison study includes compact fluorescent fixtures; please clarify. The circular fluorescent lamps are known to cost more than conventional 40 W lamps. The circular fluorescent fixtures are known to provide lower light output than conventional 40 W lamps after aging. Please discuss.

5 D.RUHL CENAB-EN-D MEC

We expect the study to be resubmitted with all of the appropriate corrections incorporated.

List ...
Encl 2

10 K-11

* RESPONSE TO COMMENTS
(NO. 1)

Minutes of Meeting

Subject	Decision/Action Summary
RESPONSE TO COMMENTS FROM CENAB-EN-MS (D. RUHL - MARCH 14, '94)	EYP Response
	1. Will comply .
	2. Cost data will be revised for Pre-final Submission (What is MCASES system ?)
	3. Replacement of existing incandescent lighting fixtures is not recommended or assumed for all fixtures. Only those fixtures which are expected to be turned on for more than four (4) hours a day were selected, which for this study are typically the fixtures in: hallways, family rooms, bathrooms and kitchens. It was therefore assumed that an average of three (3) fixtures would be replaced in a typical housing unit.
	4. The analyses performed for light fixture replacement were done without rebates from the utility company. See appendix G: Miscellaneous Analyses, "1. Light Fixture Replacement". No fixtures in dining rooms, bedrooms or living rooms were assumed to be replaced with fluorescent type (see response to Item 3).
	5. Will make recommendations to Housing Office, as it is not an energy-related issue.
	6. As stated in the cover letter, ECIP summary sheets would be included with each ECO analysis in the Pre-final Submission.
	7. Based on prior agreement with Mr. Mike Stumbaugh, at the Project Kick-off Meeting on October 14, 1993, the ASEAM and the BLCC programs would be used in the life cycle cost analysis for this project. A copy of the BLCC User's Manual is enclosed for review.
	8. See User's Manual attached. EYP will redo all analyses using LCCID if BLCC is determined to be unacceptable by the Corp of Engineers (COE).

Minutes of Meeting

Project: Ft. Belvoir ~~EMS~~ Study Date: 12/6/93

Subject	Decision/Action Summary
	9. See response to Item 8.
	10. (Comment could not be found)
	11. Will comply.
	12. Will comply.
	13. Please clarify.
	14. The word "COMPACT" which appeared on the 'divider sheets' was a typo and should have read "CIRCULAR". All calculations made were based on circular fluorescent fixtures. See Appendix G: Light Fixture Replacement Analysis.
	15. A discount factor of 4% was used in the study because it was the figure specified in the ECIP Guidance.
	16. See response to Item 8.
	17. Will comply.
	18. Will comply.
COMMENTS FROM MR. M. STUMBAUGH (PWE), FT. BELVOIR (MAR. 24, '94)	EYP Response
	1. Weatherstripping at most houses is in good condition, except in isolated incidences, where replacement would be required. Since the condition of weatherstripping has little impact on the heat gain or heat loss of the housing unit, it was not included in the list of recommended ECO items.
	2. Will revise per comment.
	3. Will revise wording as required.
	4. Will revise wording as required.

Minutes of Meeting

Project Ft. Belvoir [redacted] Study Date: 12/6/93

Subject	Decision/Action Summary
	5. Will provide explanation on how each 'alternate' differs from the 'baseline'.
	6. We concur. We understand PWE will set up the meeting and will notify EYP as to the time, date and location.
	A. Copies of comments on the Interim Submittals of subject projects were given to EYP by Mr. Stumbaugh. Discussion followed.
	A. EYP will send Mr. James Hawk letter to explain why 'BLCC' program, not 'LCCID', was used for life cycle cost analysis.
	B. Upon receipt of all the information from COE, as agreed upon at this meeting, EYP will proceed to incorporate all comments from COE and Fort Belvoir (the Post) into the Interim Submittal, and submit an Updated Interim Submittal to COE within four (4) weeks.

Monday March 14, 1994
Last Sort Type = Page/Sheet #

Housing Insulation Study, Ft. Belvoir, Interim

File: C:\ARMS\PUBLIC\DB4152DR.DBF

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
1	D.RUHL	CENAB-EN-D	15	MEC	

"History of utility costs" shall be provided in appendix.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
2	D.RUHL	CENAB-EN-D	15	MEC	

Explain why cost data has not been gathered using the MCASES system.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
3	D.RUHL	CENAB-EN-D	16	MEC	

Fluorescent should not replace incandescent throughout the entire dwelling unit.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
4	D.RUHL	CENAB-EN-D	18	MEC	

Replacement of existing incandescent fixtures shall be included in the study whether or not utility incentives are offered. Do not consider ircular fluorescent fixtures. Do not consider fluorescent fixtures in the dining rooms, bedrooms, or living rooms. Use decorative fixtures in dining rooms.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
5	D.RUHL	CENAB-EN-D	4	MEC	SURVEY

Consider improving dryer duct through plywood window light.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
6	D.RUHL	CENAB-EN-D	ECIP	MEC	

Provide the required ECIP summary sheets for each investigation which proposes to use the ECIP program. Be advise that the use of the LCCID routine obviates the hand written ECIP summary sheets.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
7	D.RUHL	CENAB-EN-D	GENERAL	MEC	

The LCCID routine shall be used to investigate life cycle cost analysis in accordance with the requirements of AEI Ch 11. Clarify if the special certification of other routines has been obtained as required by AEI Ch 11.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
8	D.RUHL	CENAB-EN-D	GENERAL	MEC	

Provide sufficient description of the life cycle cost routine which has been used in order to convince us that it mimics the LCCID routine which we prefer. The LCCID routine contains specific options for analyzing ECIP rojects and it should be used.

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
	D.RUHL	CENAB-EN-D	NON-ECIP	MEC	

on-ECIP comparisons should use the LCCID routine because it satisfies the requirements of TM 5-802-1 which is the principal economic analysis

Monday March 14, 1994 Page: 2
Last Sort Type = Page/Sheet #

Housing Insulation Study, Ft. Belvoir, Interim

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
10	D.RUHL	CENAB-EN-D	NON-ECIP	MEC	

11 D.RUHL CENAB-EN-D PART C MEC
The weather data input for the analysis shall be in accordance with TM 5-810-1 and TM 5-785 not ASHRAE. Include dry bulb and wet bulb information.

12 D.RUHL CENAB-EN-D PART C MEC
Summer indoor temperatures and winter indoor temperatures shall be in accordance with TM 5-810-1. Ch. 2.

13 D.RUHL CENAB-EN-D PART E MEC
Indicate the criteria for the 20 year study period.

14 D.RUHL CENAB-EN-D PART F MEC
Explain why the survey discusses circular fluorescent fixtures but the comparison includes compact fluorescent fixtures.

15 D.RUHL CENAB-EN-D PART F MEC
The discount rate shall be over and above inflation rate as required by TM 5-802-1 Ch.2.

16 D.RUHL CENAB-EN-D PART F MEC
The discount rate indicated by the latest version of the LCCID routine is the correct value to be used for the analysis.

17 D.RUHL CENAB-EN-D PART G MEC
Substantiate the life expectancy indicate for the circular fluorescent tubes.

18 D.RUHL CENAB-EN-D PART G MEC
Provide calculations to substantiate the attic exhaust fan cooling.

File: A:\COMMENT\INTRM.CMT
Printed: Thursday March 24, 1994 at 9:51:34 a.m.

Project Info: FH Insulation Study

Num	Name	Office	Page/Sheet	Discipline	Rm/Detail
1	STUMBAUGH	PWE	2-	SPE	FH

Should weatherstripping be included in this table?

2	STUMBAUGH	PWE	5-	SPE	FH

This study is intended to establish the current state of energy consumption : six neighborhoods on the Installation and recommend economically viable optic to improve energy consumption as evaluated against ECIP criteria.

3	STUMBAUGH	PWE	5-	SPE	FH

Five percent of units in each neighborhood were surveyed as established at tl project entry conference.

Realizing the purpose of this study requires that existing performance be assessed and ECOs evaluated. - not a complete sentence

4	STUMBAUGH	PWE	8-	SPE	FH

Weatherstripping is missing at front doors and require maintenance at the sic ɔors.

5	STUMBAUGH	PWE	5-	SPE	FH

As with the EMS study, the computer model strenghts and limitations must be spelled out. Tje factors changed from the base case must be clearly defined. How was increased insulation simulated? How was better weatherstriping simulated?

6	STUMBAUGH	PWE	5-	SPE	FH

We will need to discuss how the recommended ECOs shall be packaged for ECIP o other funding consideration.